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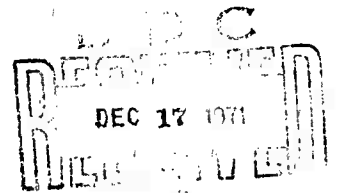


# **MACHINE-AIDED INDEXING**

**Paul H. Klingbiel**

**Directorate of Development**

**December 1971**



**Technical Progress Report for Period July 1970 - June 1971**

**DEFENSE DOCUMENTATION CENTER**

**Defense Supply Agency**

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Progress is reported at the 500,000-word level on the development of a partial syntactic analysis technique for indexing text. The overt error rate at this level is 3.1% (1012 overt errors in 32662 candidate index terms). New and revised indexing subroutines are provided. Computer speed is good. About one million words of text can be indexed in one hour of CPU time.

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**PREFACE**

This is the third annual report covering the development efforts in machine-aided indexing (MAI). The partial automation of indexing is part of a larger effort which includes the automation of bibliographic searching so that the casual on-line user can receive a reasonable response to a question expressed in natural language. Both indexing from text and the use of natural language for search and retrieval require the existence of a large natural language data base (NLDB). Machine-Aided Indexing, Machine-Aided Retrieval (MAR), and the Natural Language Data Base are all currently being developed and are at different points of completion.

The contents of this report indicate the status of MAI as of 30 June 1971. Current efforts are devoted to indexing enough text (three to four million words) so that the system may be used in an operational environment as rapidly as circumstances permit. We are attempting to hold the error rate down and maintain processing speed as the data base enlarges.

The NLDB is being constructed now using the index terms generated by MAI during the period covered by this report. We anticipate having an operational NLDB by 31 December 1971.

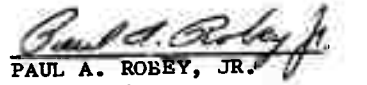
A contractual effort to automate the bibliographic search function has been completed, and a technical report 1/ has been issued. Additional work under the general heading of machine-aided retrieval has begun in-house. Initial efforts are devoted to a study of the retrieval lexicon; this study includes a comparison with the MAI dictionary and standard thesauri. Technical reports will be issued as information on the results of these efforts becomes available.

An effort to convert the MAI programs to COBOL is progressing satisfactorily. The existence of a conversion program will make MAI exportable. Our own in-house efforts utilize programs written in assembly language on the UNIVAC 1108 operating under EXEC 8.

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## THE MACHINE-AIDED INDEXING SYSTEM

### Recognition Dictionary

The format of this dictionary has been retained through the indexing of 565,011 words of text. All entries for that corpus are single words. No hyphenated forms or alphanumeric combinations were carried. The nine word classes established previously were retained.

The statistics for the dictionary items assigned to each macro for the 565,011 words of text are as follows:

<u>MACRO</u>	<u>WORDS</u>	<u>MACRO</u>	<u>WORDS</u>
1	1998	9	end of field
2	1721	10	1
3	2578	11	comma
4	1	12	1
5	special symbols	13	hyphen
6	2566	14	13
7	9659	15	8
8	1		

The computer dictionary held only 8,888 words, i.e., macro 7 was not held. A concerted effort was made to reduce the macro 7 words (mostly of low frequency) to one of the other categories. Although that task was not completed when an additional 211 DD 1634 reports became available to us, the impact can be seen in the following statistics as of 621,124 words of text. (The 56,079 words of text from the 211 reports contributed only 333 new types.)

<u>MACRO</u>	<u>WORDS</u>	<u>MACRO</u>	<u>WORDS</u>
1	4288	9	end of field
2	1926	10	1
3	2725	11	comma
4	1	12	1
5	special symbols	13	hyphen test
6	2764	14	13
7	7152	15	18
8	1		

The million-word mark has been exceeded, but macro assignments are not yet complete. Preliminary statistics indicate about 25,000 unique words at that level. This is a startling contrast to the finding of Kucera and Francis, 2/who reported 50,406 unique



types at the same level. The difference cannot be explained on the basis that our vocabulary is drawn from a narrowly defined technological field while that of Kucera and Francis represents general English. The million-word data base, to be sure, is a technical English data base, but it is across the board in that it covers all of the disciplines listed in the COSATI Subject Category List.<sup>3/</sup> Several million-word data bases are becoming available, and a report on some of their statistical features will be prepared.

#### Indexing Subroutines (Macros)

Unfortunately, errors appeared in the indexing routines given in the previous report. <sup>4/</sup> Macro 1, pages 11 and 12 of that report, was printed with a line missing. It is given in its correct form in its entirety immediately below. Macro 4, page 13 of the previous report, had two instructions reversed. This macro, too, will be repeated in its entirety. Macro 10 is for the word "or," not the word "on" as stated in the previous report.

#### MACRO 1

- I. Clear RR.
- II. Is TS empty? If
  - A. YES - Read in next word.
  - B. NO - Do contents of FR match FD?
    1. YES - Write TS on IT; clear FR, TS, and read in next word.
    2. NO - Does last character in FR match either P, X, Y, A, B, or +? If
      - a. YES - Drop last character in FR and last term in TS. Go to step II.
      - b. NO - Does FR contain a "P?" If
        - (1) YES - Does FR match any of the special "of" formats? If
          - (a) YES - Does TS match special tables? If
            1. YES - Write contents of TS on IT; clear FR, TS, and read in next word.

2. NO - Do contents of FR before "P"  
match FD? If

a YES - Write TS before "of" on  
IT. Do contents of FR after  
"P" match FD? If

i YES - Write TS after "of"  
on IT; clear FR, TS, and  
read in next word.

ii NO - Clear FR, TS, and read  
in next word.

b NO - Do contents of FR after P  
match FD? If

i YES - Write TS after "of."

ii NO - Clear FR, TS, and read  
in next word.

(b) NO - Go to step IIB2b(1)(a)2.

(2) NO - Clear TS, FR, and read in next word.

MACRO 4  
(and)

I. Is TS empty? If

A. YES - Clear RR and read in next word.

B. NO - Is last character in FR an "A?" If

1. YES - Does FR contain less than 4 characters? If

a. YES - Place + in FR, "and" in TS. Clear RR and  
read in next word.

b. NO - Delete last symbol in FR and last term in  
TS and go to macro 1.

2. NO - Go to macro 1.

The following macro is a replacement for macro 13 as given on  
page 11 of the previous report. Test shots with this macro have  
been very encouraging.

### MACRO 13

- I. Is TS empty? If
- A. YES - Clear RR and read in next word.
  - B. NO - Store hyphen in TS - read in next word and go to step II.
- II. Is word followed by a hyphen?
- A. YES - Go to I B.
  - B. NO - Store an "A" in FR and term in TS. Read in next word.

Macro 16 is a trial balloon. Words assigned to this macro cannot occur initially. In all other respects they act like weak nouns.

### MACRO 16

- I. Is TS empty?
- A. YES - Clear RR and go to macro 1.
  - B. NO - Store a "Z" in FR and term in TS and read in next word.

### Format Dictionary

The 75 formats recognized by the format dictionary and the frequency of their occurrence in the 450,000-word data base are as follows:

<u>Rank</u>	<u>Frequency</u>	<u>Format</u>	<u>Rank</u>	<u>Frequency</u>	<u>Format</u>
1	9,518	ZZ	16	416	NZZ
2	7,283	N	17	411	NN
3	7,243	AZ	18	391	ZPN
4	2,355	ZZZ	19	368	ZPZZ
5	2,325	AZZ	20	317	ZNZ
6	1,886	NZ	21	265	A+AZ
7	1,391	AN	22	261	AAZZ
8	1,273	ZN	23	224	ZZN
9	820	ZPZ	24	164	ZAZZ
10	712	AAZ	25	148	AZAZ
11	535	ZAZ	26	115	AAN
12	510	AZZZ	27	112	AZZZZ
13	426	ANZ	28	109	ZAN
14	422	AZN	29	107	NAZ
15	420	ZZZZ	30	102	AZNZ

<u>Rank</u>	<u>Frequency</u>	<u>Format</u>	<u>Rank</u>	<u>Frequency</u>	<u>Format</u>
30	102	ZPAN	27	AA+AZ	
31	98	BN	26	ZZZN	
32	94	ZPNZ	26	NAN	
33	84	ANZZ	19	ZZR	
33	84	NPZ	18	AXAZ	
34	81	A+ZZ	13	BR	
35	74	ZZAZ	9	AZR	
36	72	ANN	9	NNZZ	
37	68	A+AZZ	8	AA+AZZ	
38	66	ZZZZZ	7	ANZZZ	
	64	ZR	6	ZNZN	
	62	ZNZZ	6	AXAN	
	59	AZAZZ	5	NAAZZ	
	56	NZZZ	5	A+YZ	
	53	AZZN	5	AA+AN	
	52	ZZPZ	3	A+YZZ	
	49	NZN	3	ARZ	
	47	AR	3	AXAZZ	
	45	A+AN	1	A+XAN	
	45	ZZPN	1	A+XAZ	
	41	ZNN	0	A+YN	
	30	NNN	0	A+YAN	
	28	ZAZZZ			

The first five formats by frequency rank identically to that found for the 115,094-word corpus. Additional formats will be added to the dictionary as explained on page 24. More study is needed, but the suspicion is growing that certain words are sufficiently context sensitive in terms of occurrence as word initial, medial, or final as to warrant setting up several new word classes. This, of course, would somewhat increase the number of recognized formats.

#### Natural Language Data Base

In an operational environment, all candidate index terms are to be screened against the NLDB. This screen has been constructed and was in keypunch at the time this report was prepared. No data on the NLDB will be available until the next reporting period.

The NLDB is intended not only to screen out all of the errors listed in appendix C, Errors of Commission, but also to screen out syntactically correct but useless terms for retrieval. Estimates of this category run as high as 16 to 20 percent of the total candidate index terms. If this estimate is validated, the MAI programs would be producing useful index and retrieval terms about 75 percent of the time.

An additional in-house effort is now underway to compare the vocabulary, both on an individual-word basis and on a retrieval index-term basis, of the language of the requester with the language of the report writer. As that material becomes available, insofar as it affects the MAI project (either in macro assignment, format occurrence, or presence in the NLDB), it will be reported as part of each annual MAI report. The material may very well be of sufficient interest to warrant separate publication.

## NATURAL LANGUAGE DATA

### Statistics

An interesting feature of text is the occurrence of long stretches of text, six words or more, unbroken by a throw-away word. Such sequences occurred in the initial 125,000-word base reported on previously, <sup>4</sup>but were not discussed because many of them were attributable to deficient punctuation. The new data base is normal with respect to punctuation, and therefore the long stretches are an actual feature of the text.

A feeling is growing that stretches of text longer than four words are too specific for retrieval. This hunch will be checked against the stretches of text actually found in retrieval requests. Note that the present format dictionary contains the following five-word formats.

AZZZZ	ZAZZZ	AA+AN	A+YAN
A+AZZZ	AA+AZ	A+YZZ	AXAZZ
ZZZZZ	ANZZZ	A+AZZ	
AZAZZ	NAAZZ	A+XAN	

It also contains the six-word format, AA+AZZ. Unclassified examples of these formats are given in appendix A. Statistically, there were 385 stretches of five words and 8 stretches of six words recorded by the format dictionary and accepted as candidate index terms in the 4K data base. However, if mismatches are included, the statistics are as follows:

- 776 stretches of five words
- 120 stretches of six words
- 66 stretches of seven words
- 14 stretches of eight words
- 5 stretches of nine words
- 2 stretches of ten words

Of the 983 stretches of five words or more, only 267 involved either "and," "of," "or," or "other." Consequently, the majority of these long stretches consist of adjectives and nouns only. Unclassified examples of stretches up to and including six words have been given in appendixes A and B. Unclassified stretches longer than six words are given immediately below.

#### Seven Words

structural electrical magnetic and optical functions materials  
doppler inertial and radio inertial error analysis  
organic polymeric electronic and composite ceramic materials  
potential lethal incapacitating or riot control agents

Army ABM defense system ground support facilities  
 small stationary and portable nuclear power plants  
 subsonic and supersonic reaction jet flow models  
 high and low cycle fatigue crack growth  
 single or multiple stationary or moving targets  
 attenuated western and eastern equine encephalitis vaccines  
 very high and very low frequency signals  
 lethal and incapacitating or riot control agents  
 CW yag single mode single frequency laser  
 very low power small size frequency synthesizer  
 man portable and mechanized flame weapon systems  
 portable and tower air traffic control radios  
 aerial fire support air craft propulsion system  
 aerial fire support air craft qualification program  
 utility tactical transport aircraft propulsion system planning  
 reusable lifting reentry heat shield panel simulations  
 depth technical and cost effectiveness trade offs  
 electrical, optical, magnetic and electro acoustic properties  
 offensive and defensive air force weapons systems  
 fast neutron elastic and inelastic cross sections  
 reliable data compaction and automatic image processing  
 homogeneous and heterogeneous free turbulent mixing flows  
 flame and shock tube chemical kinetic studies  
 prototype gas turbine engine oil base stocks  
 civilian pay and EDP equipment rental areas  
 tropospheric scatter and air ground radio links  
 integrated maneuvering and life support system contracts  
 symmetry metal oxide silicon random access memory  
 wind tunnel and free flight test techniques  
 neutron elastic and inelastic scattering cross sections  
 free flight weapon stores environmental test criteria  
 dynamic crew seat crash loads test program  
 pylon mounted variable geometry external fuel tank  
 low altitude proximity low altitude proximity delay  
 lightweight and heavy transportable communications equipment programs  
 variable deflection thruster fluidic flight control system  
 continuous oxygen carbon dioxide ion exchange system  
 reliable sewage sanitary waste treatment removable systems  
 portable direct reading automatic ultrasonic test system  
 high altitude military or commercial supersonic flight  
 high frequency bulk and surface wave applications  
 compact closed cycle light weight miniature refrigerators  
 new wire reinforced CB composites creep rupture  
 low and high energy electron diffraction studies  
 irradiated reactor structural and fuel cladding alloys  
 turbojet and other air breathing propulsion systems  
 radioactive waste disposal system distillate cooling system

#### Eight Words

low energy electron diffraction high energy electron diffraction  
air defense small caliber fluid propellant weapon system  
nuclear weapons effects research test nuclear effects simulators  
skid mounted closed Brayton cycle power conversion system  
exploratory model high powered pneumatic actuated water cannon  
small gun rugged high rate reserve power sources  
switch high power gallium aluminum arsenide injection lasers  
depth technical and cost effectiveness trade off studies  
extremely high frequency solid state delay lines amplifier  
integrated airframe exhaust nozzle wind tunnel testing techniques

#### Nine Words

barge mounted and deep underground nuclear power plant studies  
ablativ structural and ablativ nuclear hardened missile heat shield  
liquid rocket propellant resistant long life value seat material  
phase of head mounted high resolution acoustic lens sonar

#### Ten Words

computer science software theory pattern recognition techniques  
numerical computer techniques

Some of these stretches are suspicious: for instance, the one example of a ten-word stretch. The context of the whole sentence reveals that a comma is missing after the first instance of "techniques." Consequently, there is really only a seven-word stretch. On the other hand, the last instance of the nine-word stretches is bonafide, though peculiar. The context is:

...complete exploratory development phase of head mounted high resolution acoustic lens sonar and prepare...

The only reason this is not an eleven-word stretch is because we have chosen to mark "development" a throw-away word. Consequently, the statistics made available through our indexing programs cannot be taken as indicating "true" linguistic entities. This is a problem. One wants to discover certain patterns of natural text both for the sake of (1) knowing what some of the textual patterning features are and (2) using the information, if possible, to optimize the total system. The MAI system is deviant in the sense that each word has only one part of speech while natural language allows lexical entities to function in a multiplicity of ways. Additionally, the part of speech assigned does not always conform to the traditional partitions: traditional grammar does not distinguish between stand-alone nouns and nouns requiring modification. Indeed, this feature is completely idiosyncratic so that



given another data base, different choices would be made without thereby changing the basic MAI logic. Finally, there is the choice of throw-away words, including "development," "design," etc. The absence of such nouns and adjectives obviously influences the frequency of occurrence of two-word, three-word, etc., adjective phrases. More will be said about this topic at the million-word level.

### Incorrect Assignment

Appendix C lists examples of various kinds of errors of commission. Statistically, the following error pattern of commission pertains:

<u>Error Type</u>	<u>Total</u>	<u>U</u>	<u>C</u>	<u>S</u>	<u>Percent of Total</u>
1	512	315	150	47	50.59
2					
3	167	114	43	10	16.50
4	84	46	31	7	8.30
5	18	10	4	4	1.78
6	25	18	7	-	2.47
7	138	93	37	8	13.64
8	13	9	3	1	1.28
9	14	13	1	-	1.38
10	25	17	6	2	2.47
11	3	2	1	-	0.30
12	2	2	-	-	0.20
13	11	9	-	2	1.09
TOTALS	1012	648	283	81	100.00

This table lists a few more error types than presented in the previous report.<sup>4/</sup> In addition, category 7, which had previously referred to a special symbol deleting problem, has been expanded to cover a punctuation problem involving commas. Instances are listed in appendix C. Error type 11 requires a new syntactic format for its correction; error type 12 is adverb-noun confusion; error type 13 resulted from a programing error (since corrected).

For comparative purposes, the percentage of error for each error type is listed for the 115,000- and the 450,000-word data bases.

<u>Error Type</u>	<u>1K Base</u>	<u>4K Base</u>	<u>Change</u>	<u>Error Type</u>	<u>1K Base</u>	<u>4K Base</u>	<u>Change</u>
1	15.36	50.59	+	8	1.12	1.28	+
2	1.50	-	-	9	29.21	1.38	-
3	20.97	16.50	-	10	1.12	2.47	+
4	17.23	8.30	-	11	-	0.30	
5	0.37	1.78	+	12	-	0.20	
6	5.24	2.47	-	13	-	1.09	
7	7.87	13.67	+				

Five error types show percentage decreases for the 4K vs the 1K data base. These are:

Error type

- 2 - Adjective-noun confusion.
- 3 - Noun-verb confusion.  
(40% of these are words ending in "ing.")
- 4 - "And" logic (macro 4).
- 6 - Goofs.  
(It is nice to see this category decrease.)
- 9 - Missing punctuation.  
(This verifies our remarks that the 1K data base was unusually bad with regard to punctuation. The current percentage may very well represent an unreducible residue under normal proofreading practices.)

Eight error types show percentage increases, including three new error type categories. The categories showing increases are:

Error type

- 1 - A preceding or a following word is a throw-away word and the partial phrase identified coincidentally matches an acceptable format (this is the largest source of error).  
The problem will be discussed below.
- 5 - Style, such as adjective following noun.
- 7 - Special symbol problems including commas in very long phrases.
- 8 - Macro 8 logic (of).
- 10 - Adjective-verb confusion.
- 11 - New format required.
- 12 - Adverb-noun confusion.
- 13 - Programing error.

Error types 1 and 6 may remain high for some time. Initially, we had a working rule to the effect that a macro number would not be assigned to a word until we had at least five instances of the use of that word. This practice accounts for the inordinate number of macro 7 designations (page 1 ). Because several million-word bases are now becoming available and because the statistics of these bases appear to differ significantly from that of Kucera and Francis, 2/we are now making decisions on all words. This policy will probably result in more type 1 and 6 errors, but it will give us a statistically clean file.

The following words, in alphabetical order, were responsible for the type 1 errors. The frequency of the word through 565,000 words of text is given, the macro number assigned at the time indexing took place, and the new macro assignments, if any. There has not been time

to review all of the words, and there is no implication that such review will necessarily result in a macro change. Some errors will be unavoidable. The number in parentheses to the left of some words indicates the number of times the word caused trouble. All other words caused trouble only once.

<u>Freq</u>	<u>Old</u> <u>Macro</u>	<u>New</u> <u>Macro</u>	<u>Word</u>	<u>Freq</u>	<u>Old</u> <u>Macro</u>	<u>New</u> <u>Macro</u>	<u>Word</u>
1041	1		advanced	17	2	2	firings
28	1		advancing	1	7		Fishers
168	1	6	agents	9	2		flat
1317	1		analysis	12	7		flir
541	1		application	12	1		(3) focal
231	1		approaches	1	7		Fesnel
2	7	2	Asian	134	1		full
24	6		attitude	12	2	1	functioning
16	1		augmentation	319	1		general
408	1		basic	2	7		graded
17	1		bits	1	7		Greenbrier
5	7		boring	93	1		(2) groups
6	1	16	bound	120	1		(7) higher
43	7	6	bridge	3	7	1	homework
11	1		call	1	7		Hopkinsons
670	1		capability	168	1		improvements
1	7		chaplain	12	7	1	indicating
54	7		characterization	2	7	2	instant
1	7	6	cleaner	178	1		interest
20	7	1	competence	508	1		investigations
636	1		(3) concepts	126	1		IR
33	1	6	conference	32	1		larger
8	7	6	conferencing	15	7	1	latitude
73	1		content	3	7	1	leg
2	7		contours	174	1	6	line
194	1		critical	26	7	1	longer
157	7	6	delivery	26	1		manipulation
1609	1		design	22	1	6	master
189	1		designs	260	1		(2) measurements
3471	1		(4) development	119	1		measuring
206	1	16	(3) device	75	1		medium
1	7		diffused	2	7		micropound
4	7		downward	71	1		modeling
1060	1		effort	9	7		moderate
1	7		ellipsometry	2	7	6	morbidity
1	7	6	Eloden	3	7		navion
16	7	2	equivalent	421	1		(1) one
116	1		establishment	232	1		operating
1000	1		evaluation	187	1		optimum
234	1		(2) experiments	2	7	1	pads
105	1		extended	71	1		papers
3	7	2	fabric	2	7	2	polylactic
1	7	6	fibre	4	7		powers

<u>Freq</u>	<u>Old</u> <u>Macro</u>	<u>New</u> <u>Macro</u>	<u>Word</u>	<u>Freq</u>	<u>Old</u> <u>Macro</u>	<u>New</u> <u>Macro</u>	<u>Word</u>
729	1	6	processing	8	7		stand
2	7		profiler	1	7		siting
15	7	2	Q	49	1		store
8	7	3	radiac	1215	1		study
188	1		reference	1	7	3	subprojectile
36	1		referral	2	7		swing
62	1		relationship	1	7		talk
8	7		repetition	977	1		task
67	7	6	resistance	826	1		(2) technology
11	7	2	(2) rough	8	1		transform
19	1	1	routine	4	7		trouble
23	1		schedules	21	7	1	turn
90	1		scheduling	447	1		two
394	1		(4) service	307	1		type
367	1		services	208	1		(2) types
64	1		(2) site	212	1		(2) unit
1	7	1	sizing	528	1		various
5	7		slant	1	7	1	views
2	7		slaved	2	7		vuilleumier
176	1		source	1	7		Wankel
341	1		special	8	7		weighted
2	7		spectrally				

A high frequency term such as "advanced" is extremely tedious to recheck and its potential payoff is very small. The fact that the word was a throw-away word caused only a single error despite its high frequency of occurrence. A word like "Asian," on the other hand, has a high payoff. Although it occurred only twice, our failure to mark it caused an error.

From a slightly different point of view, words like "unit" (modular x-ray unit), "device" (coaxial dense plasma focus device), and "technology" (naval ship hydromechanic technology) pose a different problem. The word sequences, modular x-ray, coaxial dense plasma focus, and naval ship hydromechanic, are obviously incomplete. Yet, from a retrieval point of view, the addition of the missing last word does not generate a useful retrieval term. That is, words like "unit," "device," and "technology" appear to serve more as phrase "completers" than as useful retrieval concepts. Indeed, except for their role as phrase completers, these words in isolation are much too general for retrieval.

Finally, the problem comes to this. If these and similar phrases are held to be of no utility, then nothing need be done about words like "unit," "device," and "technology." If these phrases represent useful content, even if eventually transformed, for instance, from "naval ship hydromechanic technology" to "naval hydromechanics," the completer words must appear in the indexing output in order to work with grammatically complete phrases. In this event, context sensitive

rules may be required in order to limit the selection of these terms to just the "completer" context. At this point, no decision on the matter has been reached.

The words, "one" and "two," appear on the list as throw-away words. The word "three" has been marked as an adjective (macro 2). The other numbers, "four," "five," "six," "seven," "eight," "nine," and "ten," are all macro 1 words. I decided to investigate the contexts of these words to see if "three" is indeed unique or whether we had been inconsistent in our treatment of these number names. The relevant contexts of one, two, three and ten occur below (numbers in parentheses indicate the frequency of this combination).

a long term one  
 a manual one for  
 a pressing one  
 an explosive one  
   plus one (12)  
   weapons one  
   sub one  
 how does one construct  
   only one  
   into one  
   NSAP one (2)  
     one 2-d interior  
     one 10KW  
     one aircraft  
     one airman (2)  
     one AN/  
     one and  
     one another  
     one application  
     one area  
     one Army (2)  
     one arresting  
     one aspect  
     one at (1)  
     one author  
     one billion  
     one case  
     one cause  
     one complete  
     one compound (2)  
     one comprehensive  
     one consideration  
     one context (2)  
     one contractor  
     one country  
     one current and approved  
     one data reduction (2)  
     one day (4)  
     one degree

one descriptive  
 one design  
 one dimension  
 one due to  
 one ED model (2)  
 one effort  
 one employing  
 one existing  
 one exoskeletal  
 one fifth of  
 one file  
 one foot (2)  
 one for (2)  
 one frame  
 one full  
 one generation  
 one graduate  
 one half (3)  
 on the one hand (3)  
   one hemolytic  
   one Hugoniot curve  
   one hundred (6)  
   one innovation  
   one international  
   one is (3)  
   one jeep  
   one laboratory (2)  
   one large  
   one level  
   one library  
   one located  
   one major area (1)  
   one man (6)  
   one manufacturers (2)  
   one means of  
   one megawatt  
   one meter  
   one method  
   one mile (2)

one million (3)  
 one minute  
 one mirror  
 one made  
 one model  
 one module (2)  
 one mold set  
 one molecule  
 one month  
 one more  
 one municipal  
 one munition system  
 one new  
 one nucleon mass  
 one objective  
 one of (42)  
 one on (5)  
 one optimized  
 one or (15)  
 one part  
 one patient  
 one percent  
 one phase  
 one possible  
 one previously established  
 one private  
 one prototype (3)  
 one question  
 one result (2)  
 one routine  
 one runway  
 one satellite  
 one sector  
 one segment  
 one sensor  
 one set of  
 one shelter  
 one side  
 one source  
 one stop  
 one study (2)  
 one such (3)  
 one system (3)  
 one task (67)  
 one team (2)  
 one technical (2)  
 one tenth  
 one that can  
 one-third  
 one thousand (2)  
 one time (3)  
 one timer  
 one-time input (3)  
 one to (5)

one type  
 one unit  
 one university  
 one wave (2)  
 one way  
 one which  
 one will  
 one wire (3)  
 one with  
 one (1) (3)  
 one year (16)  
 phase one  
 that one has  
 that one may  
 number one priority (2)  
 the one following (2)  
 one under  
 only one  
 NSAP one which  
 VLAP one (2)  
 NSAP two (2)  
 the last two  
 the two will  
 two AD models  
 two additional (5)  
 two advanced  
 two AIM/4-D  
 two AIM/9-D  
 two analytical (2)  
 two and (2)  
 two approaches (2)  
 two areas (11)  
 two attack  
 two autodin  
 two band  
 two basic (3)  
 two bhangmeter  
 two books  
 two Boyles  
 two bridge (2)  
 two candidate  
 two carbon  
 two categories (3)  
 two cell  
 two centers  
 two Ch-47  
 two channel  
 two chemical  
 two chinese  
 two communities  
 two comparative  
 two compartment (2)

two competing (3)  
two competitive (3)  
two complete (2)  
two component (3)  
two components (2)  
two compounds (4)  
two comprehensive  
two computer  
two concept  
two concepts  
two conferences (2)  
two contexts  
two contractors  
two contracts  
two coordinated  
two correlators  
two-day conference  
two degrees (2)  
two designs  
two development  
two different  
two dimensional (3)  
two dimensions  
two distinct  
two documents  
two double  
two dual  
two earlier (2)  
two EATR's (2)  
two efforts (4)  
two electronics  
two engineering (4)  
two EST  
two events (3)  
two experimental (2)  
two experiments  
two exploitation  
two explosions  
two extensive (2)  
two extreme  
two fiberglass  
two field  
two files  
two final  
two fiscal  
two flexibly  
two flight  
two fluids  
two former (2)  
two forms

two forthcoming  
two full  
two fully  
two functions  
two FY  
two general (2)  
two graphical  
two groups  
two high  
two hours  
two hundred (2)  
two IBM  
two ICM  
two identical  
two IEEE  
two important  
two inches  
two increments  
two insert (2)  
two international  
two ion  
two issues  
two jeep  
two junior  
two kinds  
two languages  
two levels  
two lines  
two liters  
two load  
two main (2)  
two major (7)  
two manufacturers  
two marking  
two methods (2)  
two MFR (2)  
two micropounds  
two miles  
two million  
two minor  
two models (2)  
two modified  
two more (2)  
two new (11)  
two NSF  
two OAR  
two of (10)  
two QNR  
two operational  
two or (5)

two Orbach (2)  
 two ordnance  
 two organizations  
 two other  
 two panel  
 two papers (4)  
 two parts (2)  
 two performance  
 two persons  
 two phases (8)  
 two pilot  
 two place  
 two plug-in  
 two position (2)  
 two predecessor  
 two previous (2)  
 two previously  
 two primary  
 two principal  
 two problems (2)  
 two procured  
 two procurement (2)  
 two proposed  
 two prototype (3)  
 two purposes  
 two radar  
 two radomes  
 two reactive  
 two recently  
 two reports (2)  
 two rockets  
 two scheduled  
 two scientific  
 two second  
 two seismic  
 two selected (3)  
 two sentry  
 two separate  
 two series  
 two shelter  
 two signals  
 two significant  
 two SOR's  
 two sorts (2)  
 two sources  
 two stage (2)  
 two stages  
 two state  
 two station  
 two statistical  
 two-steo  
 two-step (2)  
 two steps

two strategies  
 two studies (2)  
 two study (2)  
 two subsystems  
 two symposia  
 two systems (4)  
 two task (3)  
 two tasks (12)  
 two technical (2)  
 two tests  
 two themis  
 two-thirds  
 two thousand (3)  
 two through  
 two to  
 two types (9)  
 two underway  
 two units (2)  
 two universities (2)  
 two unmodulated  
 two USSR  
 two variables (3)  
 two VC (2)  
 two very  
 two viewpoints  
 two volume  
 two-way  
 two weekly  
 two weeks (12)  
 two were  
 two wide  
 two will  
 two (2) (8)  
 two year (5)  
 two years (8)  
 two 2600  
 two 9MM  
 VLAP two (3)

the three  
 phase three  
 seventy three  
 three 130  
 three 500 (2)  
 three 40mm  
 three AD  
 three additional  
 three AFSC  
 three age  
 three AN/  
 three approaches  
 three arc seconds



three areas (12)  
 three basic  
 three broad  
 three candidate (2)  
 three candidates (2)  
 three civilian  
 three classes  
 three clusters (2)  
 three coatings  
 three commercial  
 three compartments  
 three competitive  
 three complete  
 three components  
 three concurrent  
 three contractor  
 three contracts  
 three countries (2)  
 three day  
 three depths  
 three designers  
 three developing  
 three different (5)  
 three differing  
 three dimensional (8)  
 three dimensions  
 three efforts (2)  
 three element  
 three events (2)  
 three exemplary  
 three experiments  
 three experimental  
 three factors (2)  
 three families  
 three flow (2)  
 three fold  
 three free  
 three fundamental  
 three FY's  
 three general (3)  
 three groups  
 three high  
 three hundred (2)  
 three inch  
 three interconnected  
 three interfacing  
 three interim  
 three international  
 three journals  
 three large

three levels (3)  
 three main  
 three major (2)  
 three membranes  
 three models  
 three monthly issues  
 three months  
 three more  
 three new (8)  
 three nuclear  
 three of (2)  
 three operational  
 three ordinary  
 three oscillograph  
 three other (2)  
 three papers  
 three parallel  
 three participating  
 three particular  
 three parts  
 three phases (2)  
 three phrases  
 three preliminary  
 three previously  
 three priority  
 three professional  
 three projects (2)  
 three pronged  
 three prototypes  
 three qualified  
 three quarters  
 three related (3)  
 three reports  
 three RF  
 three samples  
 three satellites (2)  
 three SDRS  
 three second (2)  
 three segments  
 three senior personnel  
 three services (5)  
 three sets  
 three sonar  
 three special  
 three stage  
 three standoffs  
 three state  
 three sub (2)  
 three subject  
 three subtasks (4)

three systems  
 three task  
 three tasks (8)  
 three teams  
 three technical (3)  
 three themis  
 three thousand (3)  
 three to  
 three types  
 three underground  
 three university  
 three US  
 three van (2)  
 three vehicles (2)  
 three volumes  
 three ways (2)  
 three (3) (2)  
 three year (2)  
 three years (9)  
 three, four and five

one year in ten (2)  
 ten active  
 ten amino  
 ten billion  
 ten dispensers  
 ten duty  
 ten environmental  
 ten individual  
 ten languages  
 ten MHCS's  
 ten micrometer  
 ten million  
 ten minutes  
 ten missile  
 ten of (3)  
 ten post (3)  
 ten research (2)  
 ten rocket  
 ten subunits  
 ten times  
 ten to  
 ten types  
 ten years

Despite the fact that one can immediately come up with contexts in which the number names would be useful, these contexts seem to be of very low frequency in text. The new hyphen macro will pick up any of these words, of course, when they occur in a hyphenated form such as "two-dimensional." Under normal circumstances, since all of the number names except "three" are throw-away words, none of the contexts listed for these terms appears as a candidate index term. My judgement is that we lose very little. About the only useful terms that appear with "three" involve the word, "dimensional." The other number names occur in contexts which are no more useful than the ones given here. Consequently, number names, with the exception of "three," appear to be throw-away words.

Finally, other circumstances which cause a type 1 error are the presence of an arabic number and certain abbreviations which are ambiguous and therefore are marked as a macro 1 at the moment. As an example of the number situation, consider the following contexts for the word "latitude:"

a parallel of latitude  
 30 degrees north  
 30 degrees south latitude  
 functions of latitude and altitude  
 a degree of latitude, not otherwise available

On this basis, if "latitude" were marked as macro 6, the only possible candidate index terms are those with numerals. Since we do not pick up numerals, we would get the incomplete "degrees north latitude" and "degrees south latitude." Actually, we have marked "latitude" as a macro 1, and I believe the above contexts clearly support that decision.

The problem of abbreviations can be illustrated by "IR," which may represent either "information retrieval" or "infrared," to mention only two possibilities. Macro assignments in these cases require a thorough study of context so that misleading index terms are not picked up (such terms would degrade retrieval performance).

#### Format Mismatches

As usual, a record was made of those strings of text which had no counterpart in the format dictionary. This record is used to determine whether significant stretches of text are being lost from a retrieval point of view. The nonmatching formats and their frequency of occurrence follow.

#### Mismatch Formats By Frequency

Rank	Frequency	Format	Rank	Frequency	Format
1	32,281	Z	22	20	NZNZ
2	906	B		20	ZBZ
3	657	BZ	23	19	AAAZZ
4	591	A	24	18	NZAZ
5	172	BZZ	25	17	AA+Z
6	88	A+		17	AZAZZZ
7	70	BAZ	26	16	AA+ZZ
8	63	A+Z		16	ANNZ
9	57	ZZNZ	27	15	AZNN
10	48	AAAZ		15	AZZNZ
11	46	AA		15	AA+
12	43	BNZ	28	14	AZZAZ
13	37	AAZN	29	13	ZZZAZ
14	34	AX		13	A+ZZZ
	34	BZZZ		13	ZB
	31	ZAAZ		13	AB
15	31	AZAN		13	ZAAZZ
	28	AANZ		13	A+N
16	28	ZANZ	30	12	AZZZZZ
	28	ZA		12	A+A
17	25	BAZZ		12	ZZAN
18	24	NAZZ	31	11	ZZZNZ
	24	AAZZZ		11	ZAZN
	24	ZZAZZ	32	10	NA
19	23	A+NZ		10	ZNNZ
20	22	ABZ		10	BZN
21	21	A+AAZ		10	ZA+ZZ

Rank	Frequency	Format	Rank	Frequency	Format
33	10	AAZAZ	39	4	A+NN
	10	NR		4	ZBZZ
	9	A+X		4	ANAZZ
	9	A+ANZ		4	ZAAZZZ
	9	AAZNZ		4	ANNZZ
	9	ANAZ		4	ZAAZ
	9	ZZZZZZ		4	ABZZ
	9	ANZN		4	AZZNN
	9	AZAAZ		3	ZAAZ
	9	AAA		3	AA+N
34	8	BANZ	40	3	ZA+AZZ
	8	ZAZNZ		3	AAR
	8	AZNZZ		3	A+ZNZ
	8	A+ZAZ		3	BZAZZ
	8	BAN		3	BA+
35	7	ZAZAZ		3	AAAAZZ
	7	AANN		3	ZAZZN
	7	AZANZ		3	A+AZAZ
	7	A+BZ		3	BAZN
	7	ZZNN		3	BAANZ
	7	BAZZZ		3	AZAZAZ
	7	AZAZN		3	NNZZZ
		ZZA		3	ANZZN
		ZZA		3	BAZZZZ
	7	ZNAZ		2	BNNZ
36	6	NNAZ	40	2	AZNZZZ
	6	AZZAZZ		2	AAZ
	6	NZZZZ		2	ZNAN
	6	BZZN		2	NZR
	6	AAZZZZ		2	AA+BZ
	6	AA+ZN		2	AAA+
	5	A+B		2	A+AAZ
	5	BA		2	AXZ"
	5	ZZAZZZ		2	ZA+AN
	5	BNZZ		2	AANZZ
37	5	ZZANZ	40	2	NZZAZ
	5	AA+AAZ		2	NZNZZ
	5	A+AAZZ		2	AA+ZZZ
	5	NZZN		2	ZANN
	5	AZZZN		2	AANZZZ
	5	NAZZZ		2	ZA+
	5	BZZZZ		2	NNNN
	4	ZAA		2	AAZAAZ
	4	NAZN		2!	BA+AZZ
	4	AARZ		2	AZAAZZ
38	4	ANNN	40	2	AZZZNZ
	4	NZAZZ		2	AAAZN
	4	AZZZAZ		2	ANA
	4	BNN		2	ZZZZNZ

Rank	Frequency	Format	Rank	Frequency	Format
41	2	AABB	1	1	ZA+B
	2	ZZAZN	1	1	BZAAZ
	2	A+NZZ	1	1	A+YNZ
	2	AZBZ	1	1	BA+ZZ
	1	BA+AZN	1	1	ZAZZAZ
	1	A+RZ	1	1	ZA+Z
	1	ZBAZZ	1	1	ABZZN
	1	ZBAZZZ	1	1	A+ZAN
	1	AA+YN	1	1	NA+NZ
	1	ZZBZZ	1	1	NAZZZZ
	1	NAZAZZ	1	1	ZAZAAZ
	1	ZNANZ	1	1	NBZ
	1	AANA	1	1	A+ZANZ
	1	ANR	1	1	ZABAZZ
	1	A+ZZNZ	1	1	NNZAZ
	1	ZAAZAN	1	1	AAANZZ
	1	BZZZN	1	1	AA+NNZ
	1	ZA+ZZZ	1	1	NZNNZ
	1	ANAAZN	1	1	NAAAAZ
	1	AZZAN	1	1	AAZZAZ
	1	AAZZNZ	1	1	ZNAAZ
	1	BZZZZZ	1	1	BZZNN
	1	ZNAZN	1	1	ZNBZN
	1	ZNNAZ	1	1	AAAZAN

Several interesting comparisons can be made with the statistics at the 100,000- and 400,000-word levels.

1K			4K		
Rank	Frequency	Format	Rank	Frequency	Format
1	10,470	Z	1	32,281	Z
2	197	A	4	591	A
3	171	R		0	R
4	152	B	2	906	B
94.6% of mismatches			93.0% mismatches		

4K		
Rank	Frequency	Format
1	32,281	Z
2	906	B
3	657	BZ
4	591	A
94.8% of mismatches		

The fact that R did not occur in isolation in the larger corpus is startling. The R class contains only 8 members. The frequency of occurrence of each in each corpus is given below:

#### Class R

<u>Word</u>	<u>1K</u>	<u>4K</u>	<u>Word</u>	<u>1K</u>	<u>4K</u>
current	187	273	parameters	46	103
government	75	40	patterns	34	214
Jersey	6	5	plastics	4	38
number	123	158	variables	37	41

Except for the word, plastics, the frequencies in the 3K corpus do not scale up as might be expected. The index routines counted 64 instances of ZR, 47 of AR, 19 of ZZR, 13 of BR, and 3 of ARZ: the legitimate formats which contain R. Ten mismatches occurred on NR, 4 on AARZ, 3 on AAR, 2 on NZR and A+AAR, and 1 on A+RZ and ANR. Unusual as it appears, it is just a chance occurrence that the R class never appeared in isolation in the 300,000-word corpus.

The overall mismatch statistics of the two corpora are quite similar. The first four format mismatches accounted for 94.6 percent of the mismatches in the first case and 94.8 percent in the second.

Formats which can be rejected immediately are also very similar in the two corpora. The first six formats in each corpus match rank exactly.

<u>Format</u>	<u>1K</u>	<u>4K</u>	<u>Format</u>	<u>1K</u>	<u>4K</u>
A+	42	88	AXA	1	
A+Z	20	63	ZYZ	1	
AA	16	46	A+XA	1	
AX	11	34	AAAAX	1	
ZA	4	28	ZB		13
AA+	3	15	AB		13
A+X	3	9	ZZA		7
AAA	2	9	BA		5
A+B	2	55	ZAA		4
AXZ	2	2	BA+		3
ZA+	2	2	AAB		2
A+R	11	13	AAX		2
A+A	1	12	AAA+		2

The first four mismatched formats by frequency, plus the other lower frequency mismatched formats of no utility for the 1K corpus, accounted for all but 4.5 percent of the mismatches. For the 4K corpus, the first three mismatched formats, plus those others of no utility listed just above, account for all but 5.9 percent of the mismatches. Unclassified instances of each of these formats is provided

in appendix B. A study of these mismatches has resulted in the following actions:

- 1) These formats have been added to the recognition dictionary on the basis that they appear to add significant retrieval terms which might otherwise be lost.

AAZN  
 ANNZ  
 AZNN  
 ZANZ  
 $A+NZ \rightarrow AZ$   
 $NZ$   
 $A+Z_1Z_2Z_3 \rightarrow AZ_2Z_3$   
 $Z_1Z_2Z_3$   
 $ZA_1+A_2N \rightarrow ZA_1N$   
 $ZA_2N$

- 2) The macro designation has been changed for the following words:

Old Macro	New Macro		Old Macro	New Macro	
1	6	agents	1	6	line
7	2	Asian	7	1	longer
7	6	bridge	1	6	master
7	6	cleaner	1	6	modeling
7	1	competence	7	6	morbidity
1	6	conference	7	1	pads
7	6	conferencing	7	2	polylactic
7	6	delivery	7	2	Q
7	6	eloden	7	6	repetition
7	2	equivalent	7	6	resistance
7	2	fabric	7	2	rough
7	6	fibre	6	1	routine
2	1	functioning	7	1	sizing
7	2	graded	7	6	stand
7	1	homework	7	3	subprojectile
7	1	indicating	7	1	turn
7	2	instant	7	1	views
7	1	latitude	7	1	weighted
7	1	leg			

- 3) The following words have been assigned to macro 16. Their previous macro assignment is indicated.

Old  
Macro

1	bound
1	device
3	growing
0	routing

Old  
Macro

0	safeguards
0	savings
0	scene
0	scenes

There are many more words which require analysis. We will attempt to partially automate this procedure by making the MAI routines themselves an analytical aid. Specifically, we intend to modify the MAI program so that it will accept as an accession one line at a time, where line is defined to mean the word under analysis and either two or three words on each side, provided such words exist. This means that the phrases listed on pages 14-19 for "one," "two," "three," and "ten" will be indexed with arbitrary designations for the word under analysis.

For example, if the word "one" is designated macro 1, then that word does not appear in any context as an index term. If "one" is designated macro 2, then "one" will appear initially and medially but never finally; nor can "one" occur in isolation. If "one" is designated macro 3, "one" is picked up in all positions and in isolation. If "one" is designated macro 4, then "one" will be picked up only if preceded by an adjective - definitely a context-sensitive condition.

By using the MAI programs to index those words which appear to be giving trouble, we can organize and condense the large amount of data quickly and display it in a form which will allow the best decision to be made. Errors cannot be avoided. We are looking for the best solution in terms of error rate and processing cost.



## PLANS FOR FY 72

1. The data base will be doubled as a minimum.
2. The investigation of "ing" words and other troublesome words will continue.
3. A context-free grammar version of the format dictionary, now in for test, will be used to check running time.
4. The NLDB will become an operational part of MAI as the final screen of candidate index terms.
5. A report will be issued emphasizing statistics at the 1,000,000-word level.

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2. Kucera and Francis, Computational Analysis of Present-Day American English, Brown University Press, 1967.
3. COSATI Subject Category List, AD 624 000, October 1965.
4. Klingbiel, Paul H., Machine-Aided Indexing, Report DDC-TR-71-3, AD 721 875.

# APPENDIX A CURRENT FORMAT MATCHES

AAN

Acute Respiratory Diseases  
Dynamic Human Perception  
Military Environmental Medicine

AAZ

Biological Neural Networks  
Extremely High Altitudes  
Naval Oceanographic Office

AAZZ

Coated Leading Edge Structures  
Flexible Offensive Gun Systems  
Oscillatory Lifting Surface Theory

AA+AN

Biological, Chemical and Physical Oceanography  
Biological Oceanography  
Chemical Oceanography  
Physical Oceanography  
Unconventional, Electromagnetic and Inertial Sensors  
Unconventional Sensors  
Electromagnetic Sensors  
Inertial Sensors  
Trained Military and Civilian Scientists  
Trained Scientists  
Military Scientists  
Civilian Scientists

AA+AZ

Biological, Radiological and Chemical Contaminants  
Biological Contaminants  
Radiological Contaminants  
Chemical Contaminants  
Biological Chemical and Physical Test  
Biological Test  
Chemical Test  
Physical Test  
Diurnal, Seasonal and Spatial Distribution  
Diurnal Distribution  
Seasonal Distribution  
Spatial Distribution

AN	Digital Tachometers Global Navigation Polar Molecules	
ANN	Electrostatic Vacuum Gyros High Purity Gallium Reversible Zinc Electrodes	
ANZ	Fixed Weapons Systems Inertial Navigation Systems Qualitative Construction Requirements	
ANZZ	High Enthalpy Gas Flows Lightweight Infantry Load Carrier Small Arms Ground Fire	
ANZZZ	Interactive Man Machine Problem Solving Naval Ordnance Systems Command Requirements Variable Geometry Fuel Tank Systems	
AR	Atomic Parameters Mach Number Reinforced Plastics	
ARZ	Atmospheric Number Density Electric Current Sheets Ionospheric Current Systems	
AXAN	Hot or Cold Climates  Hard or Soft Seafloors  Single or Multiple Stresses	Hot Climates Cold Climates Hard Seafloors Soft Seafloors Single Stresses Multiple Stresses
AXAZ	Approximate or Exact Solution  Caseless or Encapsulated Systems  Tactical or Strategic Intelligence	Approximate Solution Exact Solution Caseless Systems Encapsulated Systems Tactical Intelligence Strategic Intelligence

AXAZZ	Electronic or Proximity Time Fuzes External or Internal Flow Systems	Electronic Time Fuzes Proximity Time Fuzes External Flow Systems Internal Flow Systems
AZ	Biomechanical Forces Difference Analyses Firing Tables	
AZAZ	Closed Cycle Environmental System Electron Beam Ferroelectric Memories Gamma Ray Spectroscopic Techniques	
AZAZZ	High Efficiency Linear Power Amplifiers Low Altitude High Speed Flight Solid State Visual Display System	
AZN	Bipolar Power Transistors Thin Film Capacitors Variable Sweep Wings	
AZNZ	Thermal Fuel Cracking System Ultra Reliable Interphone System Variable Stability VTOL Aircraft	
AZR	Behavioral Science Variables Human Factors Variables Winterization System Parameters	
AZZ	Charged Particle Accelerator Laminar Boundary Layers Qualitative Flight Tests	
AZZN	Digital Time Division Multiplexer Noble Gas Ion Lasers Rechargeable Metal Air Batteries	

**AZZZ**

Aerial Fire Support System  
Automatic Test Fixture Concept  
X Ray Diffraction Techniques

**AZZZZ**

Close Air Support Gun System  
Forward Area Radio Relay Equipment  
Low Density Arc Jet Facility

**A+AN**

Acoustic and Electromagnetic Camouflage

Acoustic Camouflage  
Electromagnetic Camouflage

Analog and Digital Modulation

Analog Modulation  
Digital Modulation

Bacterial and Fungal Infections

Bacterial Infections  
Fungal Infections

**A+AZ**

Ballistic and Orbital Vehicles

Ballistic Vehicles  
Orbital Vehicles

Cardiovascular and Pulmonary Function

Cardiovascular Function  
Pulmonary Function

Gaussian and Exponential Functions

Gaussian Functions  
Exponential Functions

**A+AZZ**

Acoustic and Electromagnetic Wave Propagation

Acoustic Wave Propagation  
Electromagnetic Wave  
Propagation

Incendiary and Flame Fuel Formulations

Incendiary Fuel Formulations  
Flame Fuel Formulations

Mid and High Intensity Conflict

Mid Intensity Conflict  
High Intensity Conflict

A+AZZZ  
 Electronic and Photographic Signal Recording Media  
 Electronic Signal Recording Media  
 Photographic Signal Recording Media  
 Seismic and Infrasonic Wave Propagation Phenomena  
 Seismic Wave Propagation Phenomena  
 Infrasonic Wave Propagation Phenomena  
 Flame and Incendiary Weapon Effectiveness Methodology  
 Flame Weapon Effectiveness Methodology  
 Incendiary Weapon Effectiveness Methodology

A+YZ  
 Acoustic and Other Theory Acoustic Theory  
 Modular and Other Standard Modular Standard  
 Structural and Other  
 Applications Structural Applications

A+YZZ  
 Ferromagnetic and Other Signal Processing  
 Ferromagnetic Signal Processing  
 Nuclear and Other Munition Devices  
 Nuclear Munition Devices  
 Spectral and Other Measurement Equipment  
 Spectral Measurement Equipment

A+ZZ  
 Physiological and Threshold Effects  
 Physiological Effects  
 Threshold Effects  
 Magnetic and Velocity Fields  
 Magnetic Fields  
 Velocity Fields  
 Wound and Burn Repair  
 Wound Repair  
 Burn Repair

BN  
 Local Electroanesthesia  
 New Lubricants  
 Operational Hazards

BR  
 Complex Variables  
 New Jersey  
 Operational Parameters

NAAZZ  
 Barge Mounted Nuclear Power Plant  
 Scramjet Powered Long Range Missile

NZZZ  
 Man Machine System Performance  
 Nitrogen Cross Section Data  
 Weapons Cost Effectiveness Analyses

ZAN  
 Active Organic Depolarizers  
 Band Acoustic Transducer  
 Cable Mounted Sensors

ZAZ  
 Data Compaction System  
 Earth Moving Equipment  
 Field Cartographic Equipment

ZAZZ  
 Glass Reinforced Plastic Structures  
 Heat Actuated Refrigeration System  
 Integral Thermal Management Techniques

ZAZZZ  
 Laboratory Submerged Arc Weld Compositions  
 Potential Hard Rock Missile Sites  
 Target Activated Munition Effectiveness Methodology

ZN  
 Accelerator Physics  
 Ball Ammunition  
 Characteristic Emissions

ZNN  
 Explosive Ordnance Disposal  
 Prototype Arctic Windscreens  
 Tank Crew Clothing

ZNZ  
 Active Carbon Species  
 Body Armor Studies  
 Cloud Physics Data

ZNZN  
 Inlet Head Pressure Differentials  
 Model Dust Control Distributor

ZNZZ  
 Combat Crew Training Levels  
 Defense Ceramics Information Center  
 Image Isocon TV Camera



ZPAN	Area of Castable Rubber Production of Energetic Molecules Conversion of Floating Cause Ways	Castable Rubber Energetic Molecules Floating Cause Ways
ZPN	Angle of Arrival (Retained in Full) Studies of Electro- Statics Sets of Yarns	Electrostatics Yarns
ZPNZ	Theory of Drag Reduction Influence of Sand Waves Prediction of Transpiration Temperature	Drag Reduction Sand Waves Transpiration Temperature
ZPZ	Angle of Attack Department of Defense Equations of Motion	
ZPZZ	Function of Aerosol Environments Studies of Electrode Behavior Fabrication of Test Fixtures	Aerosol Environments Electrode Behavior Test Fixtures
ZR	Airplane Parameters Circulation Patterns Plasma Current	
ZZ	Energy Storage Fire Control Growth Requirements	
ZZAZ	Air Force Ballistic Missile Field Chamber Comparative Studies Oil Pollution Exploratory System	

ZZN	Control Surfaces Actuators Hygroscopic Particle Feeding Induction System Deposition	
ZZPN	Laboratory Testing of Adhesive Difficulty Level of Trainees Microwave Spectra of Solids	Laboratory Testing Adhesive Difficulty Level Trainees Microwave Spectra Solids
ZZPZ	Assembly Performance of Assemblies Machine Translation of Languages Time Effects of Radiation	Assembly Performance Machine Translation Time Effects
ZZR	Engine Performance Parameters Flow Field Patterns Pulse Delay Parameters	
ZZZ	Air Breathing Engines Breathing Gas Systems Gas Flow Tables	
ZZZN	Aircraft Fuel Tank Sealants Ion Exchange Bed Demineralizer Reentry Plasma Sheaths	
ZZZZ	Breech Launched Rocket Systems Dry Lake Bed Surfaces Jet Engine Compressor Blades	
ZZZZZ	Combat Vehicle Fire Control Systems Hypervelocity Re Entry Space Vehicles Time Sharing Data Management System	

APPENDIX B  
FORMAT MISMATCHES

AAAAZZ

Integrated Ablative Radiative Thermal Protection Systems

AAAZ

Antipersonnel Flame Incendiary Studies  
Bistatic HF Doppler System  
Castable Elastomeric Potting Compound  
Chemical Biological Radiological Materials  
Coaxial Heterogeneous Mixing Configurations  
Continuous Solar X Ray  
Cryogenic Shipboard Electronic Systems  
Electro Chromic Protective Material  
Electrochemical Electromagnetic Mechanical Photoelectric  
Free Turbulent Mixing Processes  
Illuminated Far Infrared Photodetector  
Manual Automatic Integrated Fire  
Mid Infrared Spectroscopic Technique  
Miniaturized Geodetic Geophysical Techniques  
Multipurpose Respiratory Protective System  
National Naval Medical Center  
Nonflammable Nontoxic High Strength  
Orthogonal Linear Phased Arrays  
Packaged Airborne Electronic Equipment  
Physical Chemical Electrical State  
Physical Mathematical Defensive Models  
Prepackaged Portable Nuclear Plant  
Reinforced Oval Cylindrical Shells  
Second Harmonic Cyclic Pitch  
Small Flexible Digital Terminals  
Tandem Van De Graaff  
Three Dimensional Lifting Bodies  
Timely Forward Looking Solutions  
Tunable Opto Acoustic Filter  
Ultra Sensitive Parametric Amplifiers  
Ultra Tuned Electronic Circuits  
Very High Protective Vehicle

AAAZN

Electronically Tuned Microelectronic Receiver Tuner  
Linear Dielectric Tuning Filter Transducers  
Slip Cast Fused Silica Radomes

AAAZZ

Empirical Turbulent Kinetic Energy Method  
Extremely Low Acoustic Propagation Velocities  
Far Infrared Atmospheric Transmission Experiment  
High Powered Regenerative Fuel Cell  
High Precision Inertial Guidance Theory  
Lightweight Pressurized Portable Plastic Extinguishers  
Mos Push Down List Memory  
Powered Wheeled Military Transport Vehicles  
Slip Cast Fused Silica Materials  
Tandem Van De Graaff Accelerator  
Three Dimensional Turbulent Boundary Layers  
Three Dimensional Turbulent Boundary Layer

AANN

Facsimile Auxiliary PCM Multiplexer  
Living Attenuated Typhus Vaccine  
Simulated South Vietnam Airfields  
Soluble Phenylated Quinoxoline Polymers

AANZ

Aerial Night Vision Applications  
Airborne Magnetic Detection System  
Audio Doppler Radar Mount  
Automated Psychiatric Nursing Notes  
Coherent Optical Radar Laboratory  
Colored Illuminating Flares Signals  
Combined Incendiary Fragmentation Effects  
Compact Automatic EEG Analyzer  
Controlled Airdrop Cargo System  
Energetic High Nitrogen Compounds  
Far Infrared Vision Systems  
Flexible Integrated Intercommunications System  
Heavy Single Flechette Cartridge  
Lightweight Inertial Navigation System  
Simulated Nuclear Blast Effects  
Simulated Nuclear Weapons Effects  
Simulated Nuclear Weapons Environment  
Solid Chemical Oxygen Generators  
Thermally Excited Nitrogen Dioxide

AANZZ

Automated Solar Flare Monitoring Systems

AANZZZ

Three Free Convection Fluid Circulation Cells  
Valid Small Arms Requirements Data Base

AAR

Atmospheric Environmental Parameters  
Cultural Demographic Variables  
Global Geodetic Parameters  
High Reynolds Number  
Measurable Crystallographic Parameters  
Solar Geophysical Parameters

AARZ

High Mach Number Flows  
High Mach Number Inlet  
High Reynolds Number Testing  
Low Atomic Number Elements

AAZAZ

Ambient Polar Cap Upper Atmosphere  
Controllable Variable Density Optical Filters  
Defensive Multiple Surface Shaped Charges  
Fast Long Wavelength Infrared Detectors  
Powered Aerial Targets Exhaust Plumes  
Short High Frequency Electromagnetic Pulses  
Very High Frequency Electromagnetic Forces  
Very Long Range Strategic Forecast

AAZAZZ

Coupled Ionospheric Magnetospheric Solar Wind Systems

AAZN

Automatic Electronic Antenna Coupler  
Buoyant Cold Weather Clothing  
Cast Foam Filled Seats  
Ceramic Reinforced Plastic Laminates  
Daily Northern Hemisphere Maps  
Hardened Bipolar Power Transistors  
High Cyclic Rate Weapons  
Horizontal Airborne Transmitting Antennas  
Ionized Turbulent Combustion Gases  
Lightweight Cold Weather Clothing

Lightweight High Performance Cameras  
 Precise Faster Response Navigation  
 Radioactive Gaseous Waste Disposal  
 Redundant Hydraulic Servo Actuators  
 Shipboard Automatic Failure Detection  
 Soft X Ray Spectroscopy  
 Solar X Ray Flares  
 Supersonic Hypersonic Combustion Ramjets  
 Tactical Phased Array Radar  
 Toxic Chemical Agent Detection  
 Ultra Lightweight Reconnaissance Transceiver  
 Ultra Short Pulse Width  
 Very High Field Strengths  
 Very High Peak Spikes  
 Very Short Radio Wavelengths  
 Wideband High Power Modulators

#### AAZNZ

Extremely High Resolution Interferometer Spectrometer  
 Fourth Solar Radio Astronomy Installation  
 Lightweight Gyro Azimuth Surveying Instrument  
 Modular Chemical Agent Detection System  
 Nuclear Powered Energy Depot Systems

#### AAZZZ

Airborne Digital Computer Systems Program  
 Close Coupled Delta Wing Configurations  
 Empirical Human Performance Effectiveness Data  
 Extremely Hazardous Air Force Environments  
 HF Single Sideband Radio Set  
 Hypersonic Leading Edge Heating Problem  
 Infrared Celestial Background Radiance Data  
 Integrated Topographic System Data Bank  
 Low Molecular Weight Combustion Products  
 Magnetic Annular Shock Tube Experiment  
 Organic Rankine Cycle Engine Generator  
 Self Sealing Fuel Cell Material  
 Shipboard Upper Air Sounding System  
 Solar X Ray Emission Lines  
 Stimulated Rayleigh Wing Light Scattering  
 Tactical Facsimile Target Display System  
 Tactical Medical Treatment Facility System  
 Tactical Wide Band Security Equipment  
 Universal High Energy Particle Detector

**AAZZZZ**

Chronic Low Power Density Microwave Exposure  
Lightweight Reinforced Plastic Composite Gun Tubes  
Miniature Combined Dosimeter Dose Rate Equipment  
Rugged High Power Crystalline Laser Materials  
Self Powered Flight Deck Light Water

**AA+AAZ**

Anti Icing and De Icing Systems  
Optical Proximity and Super Quick Plug  
Organic Inorganic and Organo Metallic Compounds  
Rotary Winged and Fixed Winged Aircraft

**AA+BZ**

Adverse Environmental and Operational Conditions  
Psychological Social and Organizational Factors

**AA+N**

Aromatic Nitro and Nitroamines  
Flame Incendiary and Smoke

**AA+YN**

Infrared Acoustic and Other Detection

**AA+Z**

Automatic Diagnostic and Inspection  
Civilian Pay and Benefits  
Perceptual Cognitive and Motor  
Physical Statistical and Engineering  
Portable Mobile and Base  
Satisfactory Functioning and Operation  
Scientific Technological and Material  
Shallow Step and Extension  
Solid Hybrid and Air  
Topological Statistical and Sensitivity  
Turbulent Mixing and Combustion

**AA+ZN**

Accelerated Wound and Fracture Healing  
Atomic Molecular and Plasma Physics  
Freeze Dried and Model Foods  
Optical Acoustic and Radio Emissions  
Visual Infrared and Millimeter Wavelengths

**AA+ZZ**

Automatic Diagnostic and Inspection System  
Computational Environmental and Reliability Requirements  
Dynamic Firings and Static Tests  
Mathematical Scientific and Management Problems  
Mechanical Thermal and Interface Phenomena  
Military Educational and Training Problems  
Nuclear Infrared and Microwave Detectors  
Opto Electronic and Laser Materials  
Positive Automatic and Reliable Identification  
Strategic Tactical and Support Aircraft  
Tactical Strategic and Reconnaissance Aircraft  
Technical Financial and Planning Data  
Technical Scientific and Program Management  
Visual Infrared and Millimeter Wave

**AA+ZZZ**

Strategic Tactical and Air Lift Forces  
Visual Infrared and Millimeter Wavelength Propagation

**ABZ**

Airborne Meteorological Data  
Atmospheric Meteorological Data  
Automatic Meteorological System  
British Meteorological Office  
Extreme Operational Environments  
Increasingly Complex Input  
Molecular Collision Dynamics  
Naval Operational Areas  
Negative Real Parts  
Psychological Operational Requirements  
Qualitative Quantitative Requirements  
Simulated Operational Environments  
Simulated Operational Environment  
Technical Operational Programs  
Three New Projects



**ABZZ**

Continuous Real Time Monitoring  
Dynamic Real Time Information  
Military Operational Support Systems  
Partially Operational Army Research  
Three New Work Units

**ANAZ**

Coated Tantalum Structural Elements  
Low Inertia Arresting System  
Low Terrain VHF Scattering  
Mortar Ammunition Applied Research  
Nonlinear Ordnance Dynamic Data  
Phototropic Dye Nondestructive Inspection  
Solar Flare X Rays

**ANAZZ**

Caseless Ammunition Automatic Test Fixture  
Insulating Substrate Epitaxial Semiconductor Systems  
Self Healing Cold Cathode Emitters  
Transonic Buffet Dynamic Load Prediction

**ANNN**

Coated Titanium Carbon Bearings  
Depleted Uranium Flechette Ammunition  
Warm Fog Condensation Nuclei

**ANNZ**

Ablative Nose Cone Materials  
Airborne MTI Radar Techniques  
Auditory Passive Sonar Signals  
Fine Dendrite Arm Spacing  
Free Swimming Diver Conditions  
High Purity Aluminum Oxide  
Lightweight Interrogator Transponder System  
Mechanized Infantry Battalion Force  
Military Survival Food Packets  
Simplified Speech Intelligibility Test  
Variable Deflection Thruster System

**ANNZZ**

Monolithic UHF Silicon Broadband Amplifier  
Photographic Radar Landmass Simulation Techniques  
Simulated Fog Flare Light Conditions  
Small Arms Ammunition Weapon Systems

**ANR**

Nuclear Fallout Parameters

**ANZN**

Chemical Ionization Mass Spectroscopy  
Coupled Torsion Bending Computations  
Digital Troposcatter Communications Modems  
Discrete Silicon Power Transistors  
Flat Trajectory Tank Cannons  
High Acuity Photo Recon  
Low Shrinkage Matrix Resins  
Warm Fog Dissipation Hypotheses

**ANZZN**

Lightweight Magnesium Dry Cell Batteries  
Magnetic Wire Shift Register Boram

**AZAAZ**

Controlled Contaminant Free Physiologic Atmosphere  
High Speed Morse Telegraph Terminal  
High Speed Rotating Electrical Machinery  
High Strength Lightweight High Temperature  
Integrated World Wide Topographic Concept  
Internal Conversion Electron Spectroscopic Techniques  
Low Energy Cosmic Gamma Rays  
Mixed Radiation Absolute Calorimetric Dosimeter

**AZAAZZ**

Free Induction Nuclear Magnetic Resonance Flowmeter  
Low Power Miniature Precision Frequency Synthesizer

#### AZAN

Charged Particle Absolute Gravimeter  
High Altitude Nuclear Detonations  
High Altitude Pilot Helmets  
High Altitude Pulmonary Edema  
High Energy Nuclear Physics  
High Energy Thermal Stimulation  
High Fatigue Resistant Joints  
High Force Cool Propellants  
High Temperature Elastomeric Polymers  
High Temperature High Stress  
High Temperature Ionized Gases  
Long Wave Infrared Sensors  
Low Energy Nuclear Physics  
Low Temperature Catalytic Oxidation  
Marine Corps Medical Evacuation  
Military Aircraft Open Cockpits  
Narrow Beam Optical Radar  
Resonant Pulse Parametric Oscillator  
Small Engine Internal Aerodynamics  
Stabilizing Light Sensitive Polymers  
Thin Film Amorphous Semiconductors  
Thin Film Piezoelectric Semiconductors  
Ultra Violet Airborne Transmissometer  
Upper Atmosphere Chemical Physics  
Wide Angle Null Steering  
Wide Band Object Camouflage

#### AZANZ

High Altitude Scientific Balloon Flight.  
High Performance Naval Weapons Systems  
High Strength Armored Crew Seat  
Integrated Ground Airborne Avionics System  
Limited Function Integrated Avionics System  
Wide Band Secure Crypto Equipment

#### AZAZAZ

High Temperature Warning System Solid State  
Thin Film Solid State Facsimile Recording

#### AZAZN

High Temperature Extreme Pressure Greases  
High Temperature Long Life Bearings  
Lighter Weight Inflatable Life Boats

AZAZZZ

Closed Loop Primary Flight Control Systems  
Colloidal Core Nuclear Reactor Rocket Engine  
Dental Panographic X Ray Scanner System  
Heavy Class Military Vehicle Propulsion Systems  
High Performance Low Light Level Television  
High Speed High Altitude Transport Aircraft  
Highest Performance Low Light Level Tube  
Low Altitude High Speed Flight Regime  
Low Level Gamma Ray Flux Measurement  
Microminiature Microwave Acoustic Surface Wave Amplifiers  
Small Reserve Fluoboric Acid Poser Supplies  
Ultra Reliable VHF FM Radio System

AZBZ

Electron Spin Lattice Interactions  
Marine Corps Operational Logistics

AZNN

Clear Air Radar Backscattering  
High Altitude Balloon Instrumentation  
High Strength Columbium Alloys  
Pathogenic Micro Organism Aerosols  
Rare Earth Cobalt Magnets  
Rotary Wing Cockpit Instrumentation  
Strategic Structures Vulnerability Hardening  
X Band Microstrip Oscillator

AZNZZ

Mobile Ocean Basing System Studies  
Mobile Ocean Basing Systems Studies  
Radiative Transport Weapons Effects Calculations  
Retinal Burn Flashblindness Prediction Model  
Single Mode CW Power Output

AZNZZZ

High Power CW Laser Radiation Studies  
Low Altitude EMP Sensor Recording Systems  
Thin Film Thermocouple Room Temperature Detector

AZZAZ

Exploratory Model Maintenance Diagnostic Set  
High Data Rate Secure Communications  
High Pressure Impact Resistant Materials  
High Sensitivity Field Warning System  
Highest Peak Power Solid State  
Lightweight Company Level Mortar System  
Low Data Rate Global Communications  
Low Dose Rate Gamma Exposure  
Low Field Strength Electromagnetic Radiations  
Solid State Devices Applied Research  
Wide Band Gap Semiconducting Compounds  
Wide Base Band Military Systems

AZZAZZ

High Performance Aircraft Thermal Control Systems  
Solar Network Making Fixed Frequency Burst

AZZNN

Ceramic Metal Plastic Armor Composites  
High Strength Beta Titanium Alloys  
Three Candidate Meningococcal Meningitis Vaccines

AZZNZ

Automated Tissue Cell Culture Control  
Controlled Air Drop Cargo Systems  
Controlled Air Drop Cargo System  
Elevated Temperature Radiation Embrittlement Sensitivity  
High Performance Aircraft EMP Testing  
Military Space Vehicle Tracking Facilities  
Solid State Micro Electronics Sciences  
Variable Speed Constant Torque Turbine

AZZZN

High Quantum Efficiency Injection Luminescence  
High Resolution Pulse Compression Radar  
Primary System Water System Purification

AZZZNZ

Airborne Surveillance Target Acquisition Radar Techniques

AZZZZZ

Anti Tank Assault Air Defense System  
Digital Data Acquisition Processing Display System  
High Data Rate Laser Communications Systems  
High Power Density Missile Power Sources  
High Power Light Weight Power Generators  
High Speed Landing Gear Track Facility  
Variable Output Gas Generator Test Program

A+AAR

Atomic and Molecular Optical Parameters  
Strategic and Tactical Military Variables

A+AAZ

Aeroelastic and Thermoelastic Structural Loads  
Antipersonnel and Anti Vehicular Mines  
Closed and Partially Closed Atmospheres  
Geophysical and Oceanographic Environmental Complexes  
Heavy and Lightweight Transportable Equipment  
Inner and Outer Solar Corona  
Lethal and Incapacitating Chemical Agents  
Linear and Digital Integrated Circuits  
Linear and Nonlinear Mathematical Programming  
Low and Extremely High Levels  
Mathematical and Electrical Analog Models  
Molecular and Atomic Spectroscopic Data  
Monolithic and Mos Integrated Circuits  
Normal and Abnormal Sensory System  
Poisonous and Venomous Marine Animals  
Subsonic and Supersonic Coaxial Streams  
Tactical and Strategic Military Aircraft  
Topographic and Military Geographic Support  
Topographic and Military Geographic Information  
Transportable and Ultra Transportable Equipment

A+AAZZ

Offensive and Defensive Chemical Systems Effectiveness  
Rotary and Piston Combined Cycle Engine  
Subsonic and Supersonic Slender Body Theory

**A+ANZ**

Armored and Anti Armor Systems  
Cold and High Elevation Regions  
Military and Indigenous New Media  
Open and Closed Iron Sights  
Organic and Inorganic Radome Structures  
Tropical and High Elevation Regions

**A+AZAZ**

Low and High Pressure Firing Tests  
Mid and Long Range Strategic Forecasts  
Rigid and High Temperature Resistant Materials

**A+BZ**

Advisory and Direct Support  
Climatic and Operational Environments  
Environmental and Operational Conditions  
International and Organizational Conflict  
Strategic and Operational Guidance

**A+NN**

Diarrheal and Skin Diseases  
Flame and Fragmentation Weapons  
Regulatory and Stress Physiology  
Utility and Cockpit Adaptability

**A+NZ**

Atmospheric and Radome Environment  
Cellular and Organ Levels  
Earthworking and Construction Equipment  
Environmental and Endurance Testing  
Gaseous and Particulate Materials  
Mechanical and Oxidation Stability  
Microbiological and Dosimetry Standards  
Naval and Marcorps Teams  
Photographic and Navigation Systems  
Physical and Adhesive Properties  
Positioning and Navigation System  
Taylor and Helmholtz Effects  
Warning and Detection Systems

**A+NZZ**

Maneuvering and Drag Compensation Functions

**A+RZ**

Industrial and Government Proposals

**A+ZAN**

Decontaminating and Dispensing Military Fuels

**A+ZANZ**

Automated and Computer Interfaced Microform Storage

**A+ZAZ**

Environmental and Shock Absorbing Properties  
Natural and Disturbed Atmospheric Environments  
Normal and Disturbed Ionospheric Conditions  
Quiet and Disturbed Geophysical Conditions  
Scientific and Management Advisory Committee  
Single and Counter Rotating Propellers

**A+ZNZ**

Microbiological and Radiation Dosimetry Standards  
Parasitic and Integral Armor Systems

**A+ZZZ**

Atmospheric and Background Light Conditions  
Ballistic and Reentry Flight Vehicles  
Biological and Liquid Metal Attack  
Electron and Ion Beam Techniques  
Normal and Emergency Flight Conditions  
Rarefied and Radiation Gas Dynamics  
Spectral and Time Signature Data  
Tactical and Air Defense Missions  
Technical and System Engineering Support  
Thermal and Flight Load Environments  
Thermodynamic and Transport Property Data

**BAANZ**

- New Automated Captive Trajectory System

**BAN**

Direct Hydrocarbon Oxidation  
New Electromagnetic Detection  
New Organosilicon Lubricants  
New Synthetic Chemicals



BANZ

Local National Labor Forces  
New Flame Weapons Systems  
New Freeze Drying Facilities  
New Lightweight Armor Materials  
New Miniature Oxygen Regulator

BAZ

Complex Biomedical Problems  
Complex Military Equipment  
Complex Military Systems  
Local Military Commands  
New Acoustic Media  
New Adaptive Technique  
New Ballistic Data  
New Biological Assays  
New Biological Information  
New Calorimetric Technique  
New Ceramic Compositions  
New Ceramic Materials  
New Chemical Compounds  
New Clinical Tests  
New Computational Models  
New Computational Techniques  
New Dielectric Materials  
New Digital Circuitry  
New Digital Techniques  
New Dynamic Stabilization  
New Electrical Performance  
New Electronic Functions  
New Electronic Systems  
New Epitaxial Films  
New High Quality  
New High Temperature  
New Incendiary Agent  
New Inorganic Compounds  
New Inorganic Materials  
New Magnetic Material  
New Mathematical Aids  
New Mathematical Theory  
New Metallic Materials  
New Microelectronic Circuits  
New Military Environment  
New Military Selection  
New Nuclear Systems  
New Optical Components

#### BAZ

- New Organic Structures
- New Polymeric Materials
- New Polyurethane Coating
- New Precise Time
- New Prime Systems
- New Probabilistic Techniques
- New Protective Equipment
- New Stabilizing Additives
- New Therapeutic Material
- Operational Electromagnetic Compatibility
- Operational Environmental Conditions
- Operational Human Factors
- Operational Hydraulic Oil
- Operational Military Systems
- Operational Tactical Settings
- Quantitative Acoustic Reflection

#### BAZAN

- New High Temperature Stable Macromolecules
- New Wideband Log Periodic Antennas

#### BAZN

- New High Speed Excavating
- New Infrared Transmitting Glasses
- New Mental Standards Airmen
- New Aerodynamic Stabilization Techniques
- New Dental Equipment System
- New Dynamic Strength Requirements
- New Hybrid Computer Techniques
- New Lightweight Aircraft Structures
- New Lightweight Wind Systems
- New Mathematical Problem Areas
- New Military Health Problems
- New Military Systems Equipments
- New Nondestructive Testing Techniques
- New Physical Conditioning Program
- New Remote Control Units
- New Self Dispersing Shapes
- New Solid State Devices
- New Supersonic Combustion Chamber
- Operational Mobile Reconnaissance Facility
- Operational Programmable Shock Strut
- Operational Topographic Data Bank

**BAZZZ**

- New Continuous Tone Reproduction Materials
- New Epoxy Dip Coating Systems
- New High Pressure Gas Apparatus
- New Parametric Surface Wave Amplifier
- New Solid Film Bonding Techniques
- New High Resolution Neutron Scattering Spectrometer
- New High Resolution Phase Signature Radars
- New Wide Temperature Range Base Stocks

**BA+AZN**

- Local Respiratory and Gastrointestinal Tract Immunity

**BA+AZZ**

- New Antipersonnel and Antimateriel Dispenser Munition
- New Atomic and Molecular Frequency Sources

**BA+ZZ**

- New Domestic and Foreign Science

**BNN**

- Local Bird Population
- New CB Decontamination
- New England Storms
- New Insect Vibration

**BNNZ**

- New Intrusion Detection System

**BNZ**

- Direct Blood Pressure
- Expanded Armor Program
- Lattice Vibration Spectra
- Meteorological Balloon Systems
- Meteorological Monograph Series
- New Carborane Compounds
- New Carborane Derivatives
- New Career Orientation
- New Construction Techniques
- New Corrosion Inhibitors
- New Dexsil Products
- New Dust Palliatives
- New Flutter Phenomena
- New Flutter Prediction
- New Instrumentation Techniques

**BNZ**

New Irritant Compounds  
New Man Machine  
New Modulation Scheme  
New Mothproofing Agents  
New Piping Systems  
New Radar Components  
New Radar Indicator  
New Transducer Devices  
New Vibration Simulators  
New Vtol Aircraft  
New Weapons Systems  
Real Battlefield Environment

**BNZZ**

New Aluminum Landing Mats  
New Oxygen Breathing Mask  
New Quartz Crystal Technique  
Operational Vtol Aircraft System  
Random Vibration Measurement Data

**BZ**

Complex Area  
Complex Environment  
Complex Environments  
Complex Performance  
Complex Plane  
Complex Position  
Complex Problems  
Complex Structures  
Complex Substances  
Complex System  
Complex Systems  
Complex Vibrations  
Direct Ascent  
Direct Communication  
Direct Effect  
Direct Effects  
Direct Fire  
Direct Impact  
Direct Measurement  
Direct Method  
Direct Navy  
Direct Observation  
Direct Potential  
Direct Power

**BZ**

Direct Ranging  
Direct Research  
Direct Response  
Direct Sounding  
Direct Support  
Direct Transformation  
Direct Value  
Direct Voice  
Expanded Activity  
Expanded Contract  
Lattice Damage  
Lattice Deformation  
Lattice Spacing  
Lattice Vibrations  
Local Density  
Local Level  
Local Purchase  
Meteorological Conditions  
Meteorological Data  
Meteorological Elements  
Meteorological Equipment  
Meteorological Measurement  
Meteorological Prediction  
Meteorological Processes  
Meteorological Rocket  
Meteorological Simulator  
Meteorological Structures  
Meteorological Support  
Meteorological Variations  
New Additives  
New Agent  
New Agents  
New Air  
New Aircraft  
New Algorithm  
New Antenna  
New Applications  
New Area  
New Areas  
New Center  
New Class  
New Codes  
New Combat  
New Components  
New Compounds  
New Computer  
New Concept

BZ

New Conditions  
New Container  
New Contracts  
New Data  
New Devices  
New Directions  
New Elements  
New Engineering  
New Environments  
New Equipment  
New Families  
New Family  
New Formulations  
New Foundations  
New Functions  
New Gas  
New Generator  
New Ground  
New Growth  
New Gun  
New Heater  
New Imagery  
New Information  
New Installation  
New Jet  
New Laser  
New Levels  
New Logic  
New Manuals  
New Material  
New Materials  
New Metal  
New Method  
New Methodology  
New Munitions  
New Navy  
New Neutron  
New Observations  
New Officers  
New Operations  
New Pad  
New Personnel  
New Phenomenology  
New Plasma  
New Potentials  
New Problems  
New Processing  
New Program  
New Programs  
New Project

BZ

New Properties  
New Proposals  
New Propulsion  
New Prototype  
New Radars  
New Reactions  
New Regions  
New Requirements  
New Research  
New Rotation  
New Seat  
New Sequence  
New Shelter  
New Ships  
New Sources  
New Species  
New Specification  
New Start  
New Starters  
New Statistics  
New Strain  
New Structure  
New Structures  
New Studies  
New Substances  
New System  
New Systems  
New Target  
New Targets  
New Technique  
New Techniques  
New Test  
New Tests  
New Theories  
New Theory  
New Tool  
New Vehicle  
New Work  
New Zones  
Operational Activities  
Operational Aircraft  
Operational Applications  
Operational Areas  
Operational Bases  
Operational Command  
Operational Commands  
Operational Condition  
Operational Control  
Operational Data  
Operational Deficiencies

Operational Doctrine  
Operational Effectiveness  
Operational Effects  
Operational Efficiency  
Operational Environments  
Operational Equipment  
Operational Error  
Operational Factors  
Operational Functions  
Operational Impact  
Operational Job  
Operational Logging  
Operational Missions  
Operational Model  
Operational Munition  
Operational Performance  
Operational Personnel  
Operational Planning  
Operational Problems  
Operational Range  
Operational Readiness  
Operational Reliability  
Operational Requirements  
Operational Restrictions  
Operational Selection  
Operational Settings  
Operational Speed  
Operational Support  
Operational System  
Operational Test  
Operational Testing  
Operational Tests  
Organizational Problems  
Organizational Requirements  
Organizational Set  
Organizational Structure  
Organizational Structures  
Organizational Subsystems  
Quantitative Calculations  
Quantitative Data  
Quantitative Description  
Quantitative Effects  
Quantitative Information  
Quantitative Interactions  
Quantitative Reliability  
Quantitative Safety  
Quantitative Solution  
Quantitative Solutions  
Quantitative Techniques  
Random Excitation  
Random Processes  
Real Problems  
Real Structures  
Real Time

BZAAZ

Direct Fire Antitank Guided Missiles

BZAZZ

New Heat Resistant Explosive Compounds  
New Interference Free Field Method  
New Polymer Pyrotechnic Fuel Mixtures

BZN

Collision Transport Integrals  
Direct Air Blast  
Direct Fire Ammunition  
New Antiradiation Chemicals  
New Polymer Binders  
New Transmission Seal  
Real Time Computations

BZZ

Complex Aerospace Communications  
Complex Computer Processing  
Complex Computer Programs  
Complex Data Bases  
Complex Energy Interactions  
Complex Flow Field  
Complex Flow Fields  
Complex Information Processing  
Complex Problem Solving  
Complex Threat Environments  
Complex Training Problems  
Direct Energy Conversion  
Direct Exposure Tests  
Direct Mode Operation  
Direct Ranging Method  
Local Command Resources  
Local Heating Effect  
Local Radiation Belts  
Meteorological Data Requirements  
Meteorological Information Criteria  
Meteorological Rocket Concept  
Meteorological Rocket Program  
New Active Exchangers  
New Aircraft Proposals  
New Alloy Materials  
New Amplification Techniques  
New Communications Concept  
New Computer Programs  
New Computer System  
New Control Techniques  
New Data Cards

BZZ

New Drug Applications  
New Emplacement Holes  
New Energy Absorption  
New Engine Cycles  
New Engineering Material  
New Explosive Fillers  
New Feeding Requirements  
New Field Studies  
New Fire Suppression  
New Gun System  
New Imaging Techniques  
New Kill Criteria  
New Laser Systems  
New Materiel Requirements  
New Measurement Techniques  
New Membrane Materials  
New Navy Contracts  
New Nonmetallic Materials  
New Performance Area  
New Personnel Management  
New Plastic Frame  
New Power Sources  
New Preservation Techniques  
New Probe Measurement  
New Problem Areas  
New Project Area  
New Propellant Systems  
New Recoil Mechanisms  
New Reconnaissance Equipment  
New Reconnaissance Systems  
New Research Program  
New Safety Devices  
New Sensor Information  
New Sensor Systems  
New Shock Tube  
New Simulation Problems  
New Storage Materials  
New Systems Simulation  
New Tank Materials  
New Technique Areas  
New Test Series  
New Test Techniques  
New Testing Techniques  
New Transmission Techniques  
New Transmitter Techniques  
New Vehicle Control  
New Wave Classification  
New Weapon Configurations



BZZ

New Weapon System  
New Weapon Systems  
New York University  
Operational Aerospace Systems  
Operational Failure Data  
Operational Flight Environments  
Operational Interference Problems  
Operational Performance Efficiency  
Operational Personnel Tests  
Operational Problem Areas  
Operational Research Techniques  
Operational Satellite Altitudes  
Operational Satellite Systems  
Operational System Efficiency  
Operational Temperature Range  
Operational Weather Forecasts  
Organizational Field Equipment  
Quantitative Performance Data  
Quantitative Satellite Tests  
Random Access Method  
Random Gust Loads  
Random Wave Studies  
Real Air Force  
Real Flight Loads  
Real Gas Effects  
Real Life Targets  
Real Time Acquisition  
Real Time Context  
Real Time Data  
Real Time Display  
Real Time Identification  
Real Time Prediction  
Real Time Processing  
Real Time Signal  
Real World Conditions  
Real World Environments

BZZN

New Metal Phosphinate Polymers  
New Power Transmission Fluids  
New Shed Light Sensors  
New Ship Concept Hydromechanics  
New Sounding System Sensors  
Operational Air Force Satellites

BZZNN

New Pulse Code Modulation Multiplexer

**BZZZ**

Complex Energy Interaction Mechanisms  
Direct Energy Conversion Processes  
Direct Energy Conversion Techniques  
Local Radio Distribution Systems  
Meteorological Data Sounding System  
Meteorological Observation System Studies  
New Aerosol Field Samplers  
New Air Force Systems  
New Airframe Reliability Criteria  
New Fire Control Systems  
New Flight Load Survey  
New Liquid Crystal Systems  
New Liquid Crystalline Compounds  
New Power Conversion Systems  
New Power Supply Systems  
New Signal Processing Technique  
New Sounding System Area  
New Weapon System Procurements  
Operational Air Force Commands  
Operational Earth Space Communications  
Quantitative Static Ground Tests  
Real Time Computer Control  
Real Time Computer Processing  
Real Time Information System  
Real Time Prediction Radiation  
Real Time Reconnaissance Displays

**BZZZZ**

New Satellite Velocity Mass Spectrometer  
New Turbine Guide Vane Material  
Real Time Data Processing Work

**BZZZZZ**

New Air Defense Computer Simulation Models

**NAZAZZ**

Fiberglass Reinforced Plastic Tail Rotor Assembly

**NAZN**

Arthropod Borne Virus Diseases  
Man Sanitary Waste Disposal  
Silicon Schottky Barrier Photodiodes

NAZZ

CIC Lighting Team Communications  
Man Tactical Support Aircraft  
Michigan International Data Archives  
Passive High Flux Neutron  
Princeton Dynamic Model Track  
SI Schottky Barrier Detectors  
Stress Acoustic Surface Wave  
Texas Social Behavior Inventory  
Thunderstorm Electrical Charge Distributions  
UHF Unfurlable Satellite Antenna  
VLF Elf Propagation Codes  
VLF LF Reflection Coefficients

NAZZZ

Battalion Close Support Weapon System  
Iron Double Focusing Beta Spectrometer  
Vtol Low Speed Flight Dynamics

NA+NZ

Man Portable and Avionics Equipments

NBZ

Ardis Operational Subsystems

NNAZ

Artillery Weapons Applied Research  
CW BW Defensive Operations  
CW BW Medical Defense  
Rain Erosion Resistant Materials

NNNN

Diver Helium Speech Unscrambler

NNZAZ

Barium Strontium Titanate Single Crystals

NNZZZ

Hydrogen Oxygen Fuel Cell Plant

NAN  
 Balloon Borne Sensors  
 Passive Human Monitor  
 Vacuum Resistant Lubricants

NAZ  
 Corrosion Preventive Compounds  
 Lightning Warning Set  
 Radar Doppler Shifts

NN  
 Oscillator Strengths  
 Payload Ejection  
 Silicon Carbide

NNN  
 Epidemic Typhus Rickettsia  
 Skin Friction Drag  
 Stress Corrosion Cracking

NNZ  
 Bond Dissociation Energies  
 Diver Speech Communications  
 Nucleation Condensation Processes

NNZZ  
 ASW Sonar Target Simulation  
 Fallout Debris Cloud Formation  
 Sand Dust Water Separator

NPZ  
 Calculus of Variations (Retained in Full)  
 Degradation of Rubber Degradation  
 Turbulence of Plasma Turbulence

NZ  
 Beach Jumper  
 CAI Techniques  
 Defoliation Activities

NZN  
 Eye Burn Hazards  
 Firepower Denial Neutralization  
 GAAS Laser Diodes

NZZ  
 Hafnium Base Alloy  
 Impurity Defect Interactions  
 Kansas State University

NR

Fallout Patterns  
Grinding Parameters  
Growing Number  
History Variables  
Moisture Parameters  
Personality Variables  
Seeding Patterns  
Sleep Patterns  
Speech Patterns

NZAZ

Additive Effects Microbial Growth  
Aluminum Alloy Structural Shapes  
Cannon Launched Guided Munition  
Cannon Launched Guided Munitions  
Drag Reduction Polymeric Additives  
Elastomer Sheet Antifouling Coatings  
GE Area Illuminating Rocket  
Indium Antimonide Schottky Barriers  
Terrain Avoidance Warning System  
Titan Vehicle Electrostatic Environment

NZAZZ

Grid Wind Tunnel Computer Technique  
Rotorcraft Flight Maneuvering Computer Program

NZNZ

Albacore Polymer Additive Program  
Aquanaut Life History Questionnaire  
Diving Failure Detection System  
Fleets Shock Hardening Program  
Magnesium Aluminate Spinel Display  
Quartz Crystal Humidity Sensor  
Sodium Chlorate Oxygen Generators  
Terrain Vehicle Man System

NZNZZ

Aluminum Wood Elastomer Composite Inserts  
Artillery Simulator Artillery Simulator Program

NZR

Blood Flow Patterns

NZZAZ

Artillery Fire Control Applied Research

NZZN

CW Operation Avalanche Oscillators  
Titanium Alloy Airframe Joints

NZZZZ

Navigation Guidance Computer Memory Devices  
Sediment Shear Wave Sound Speed

ZAAAZ

Environment Controlled Delayed Elastic Effects  
Mode Linear Partial Differential Equation  
Ultrasonic Electron Nuclear Double Resonance

ZAAAN

Explosion Resistant Hydraulic Fluids  
Fire Resistant Phenolic Foams  
Weight Protective Flexible Shelters

ZAAAZ

Active Stripline Phased Arrays  
Aircraft Mechanical Hydraulic Subsystems  
Aircraft Mechanical Hydraulic Equipment  
Aircrew Environmental Protective Systems  
Broadband Tuning High Power  
Control Chronic Respiratory Disease  
Disseminating Military Geographic Data  
Exhibits Very Brittle Behavior  
Heat Resistant Inorganic Materials  
Radiation Hardened Electronic Devices  
Radiation Resistant Rugged Reliable  
Radiation Resistant Solar Cells  
Reliable Fixed Tuned Circuits  
Reliable Hydraulic Mechanical Equipment  
Standard Finite Difference Techniques  
Testing Modular Medical Units  
Voice Excited Formant Tracker  
Wind Tunnel Free Flight  
Wind Tunnel Magnus Balance  
World Wide Climatological Data  
World Wide Environmental Requirements  
World Wide Military Command  
World Wide Military Operations  
World Wide Precise Time

**ZAAZZ**

Control Nuclear Electromagnetic Blackout Phenomena  
Exhibit Extremely Fast Diode Behavior  
Flight Maneuvering Digital Computer Program  
Prototype Centralized Automatic Test System  
Radiation Resistant Solid State Materials  
Rocket Borne Chemical Release Tests  
Stol Utility Fixed Wing Airplane  
World Wide Environmental Health Conditions

**ZAAGZZ**

Fleet Chemical Biological Warfare Defense Studies  
Point Detonating Proximity Point Initiating Base  
Prototype Self Luminous Vehicle Instrument Dials  
Wind Tunnel Magnus Effect Test Models

**ZABAZZ**

Army Wide Operational Chemical Information System

**ZANN**

Determination Small Arms Weapons

**ZANZ**

Aircraft Arresting Hook Installation  
Army Small Arms Program  
Army Small Arms Requirements  
Computer Interfaced Microform Storage  
Disturbed Polar Ionosphere Studies  
Instrument Pilot Instructors School  
Level Warm Fog Model  
Processing Red Blood Cells  
Prototype Photochromic Goggle System  
Rocket Borne VLF Receivers  
Roll Bonded Titanium Panels  
Transmission Electron Microscopy Studies  
Voice Excited Vocoder Operations

**ZAAGAZ**

Frequency Modulated Phase Locked Digital Synthesizer

**ZAAGAZ**

Army Long Range Technological Forecast  
Forecasting Long Range Military Requirements  
Forming Ceramic Metal Ceramic Structures  
Glass Reinforced Plastic Structural Rod  
Potential Deep Submergence Structural Material  
Propellant Actuated Devices Applied Research

**ZAZN**

Army Marine Craft Modernization  
Candidate Ablative Polymer Composites  
Efficiency Schottky Barrier Diodes  
Metal Bonded Diboride Composites  
Potential Solid State Lasers  
Ship Amphibious Field Medicine  
Test Remote Terminal Query  
Turbine Powered Pipeline Pumps

**ZAZNZ**

Air Mobile Aircraft Refueling System  
Composite Ceramic Metal Armor Area  
Prototype Buoyant Body Armor Assembly  
Support Worldwide Army Construction Requirements  
Watch Standing Monitoring Sonar Displays

**ZAZZAZ**

Vehicle Hydraulic System Maintenance Diagnostic Sets

**ZA+AN**

Army Offensive and Defensive Weapons  
Tank Primary and Secondary Armament

**ZA+AZZ**

Arc Second and Automatic Position Read  
Army Topographic and Geodetic Systems Requirements  
Field Medical and Dental Treatment Facilities

**ZA+Z**

Soil Applied and Growth

**ZA+ZZ**

Contract Clinical and Laboratory Research  
Fluid Dynamic and Control Systems  
Hazard Warning and Target Acquisition  
Injector Mixing and Ignition Systems  
Motor Drive and Transport System  
Processing Geodetic and Mapping Data  
Radio Astronomical and Satellite Studies  
Shot Window and Satellite Damage

**ZA+ZZZ**

Wind Tunnel and Range Test Facilities



ZBAZZ

Army Direct Aerial Fire Support

ZBAZZZ

Army Direct Aerial Fire Support Aircraft

ZBZ

Aircraft Operational Restrictions  
Army Operational Requirements  
Caliber Direct Fire  
Combat Operational Environment  
Disseminating Meteorological Data  
Engine Operational Problems  
Fleet Operational Conditions  
Fleet Operational Forces  
Logistics Organizational Structures  
Research Meteorological Teams  
Sea Operational Problems  
Shed New Light  
Spin Lattice Relaxation  
Standard Meteorological Equipment  
Support Operational Commands  
System Operational Failures  
System Operational Processes

ZBZZ

Spin Lattice Relaxation Time  
Support Meteorological Field Studies  
Support New Communication Equipment

ZNAN

Laser Scintillation Atmospheric Turbulence  
Liquid Helium Nucleate Boiling

ZNAZ

Air Leakage Sealing Mechanisms  
Aircrew Eye Protective Equipment  
Flash Blindness Protective Devices  
Ground Crew Technical Training  
Helicopter Downwash Mixing Technique  
Tank Cannon Applied Research

ZNAZN

FM CW High Resolution Radar

ZNBZN

Field Artillery Direct Support Cannon

ZNNZ

Class LST Marriage Gear  
Composite CDS Quartz Resonators  
Ground MTI Radar Techniques  
Phase Synthesis Taper Techniques  
Plasma Chromatography Detection System  
Polymer Additive Drag Reduction  
Shock Hardening Ordnance Equipment

ZZAN

Air Force Biomedical Scientists  
Air Force Clinical Medicine  
Air Force Nuclear Weapons  
Light Weight Doppler Sensors  
Materiel Support Southeast Asia  
Polymer Solutions Inhibit Cavitation  
Problem Studies Integrating Ammunition

ZZANZ

Army Engineer Nuclear Cratering Group  
Army World Wide Overseas Problems  
Flight Test Auxiliary Cooling System  
Pulse Code Modulated Multiplexer Equipment

ZZAZN

Dual Hardness Kinetic Energy Ammunition  
Millimeter Wave Solar Temperature Maps

ZZAZZ

Air Force Close Air Support  
Air Force Electronic Systems Equipments  
Air Force Global Weather Central  
Air Force Human Resources Laboratory  
Air Force Pilot Factors Program  
Ball Screw Hydropneumatic Suspension System  
Compound Semiconductor X Band Receiver  
Gun Launched Guided Projectile Structures  
Lead Sulfide Infrared Detector Materials  
Model Field Medical Laboratory System

ZZAZZZ

Air Force Close Air Support Aircraft  
Air Force Unmanned Radiation Satellite Program  
Field Army Forward Area Air Defense

ZZBZZ

Aircraft Systems Operational Safety Requirements

ZZNN

Integral Rocket Battalion Ammunition

ZZNZ

Air Defense Guns Systems  
Air Force Armament Laboratory  
Air Force Vtol Aircraft  
Air Force Weapons Laboratory  
Air Force Weapons Systems  
Air Pressure Casting Machine  
Aircraft Impact Injury Prevention  
Arsenal Laser Physics Research  
Combat Vehicle Crew Sizes  
Combat Vehicle Weapons Systems  
Draft Army Artillery Program  
Dual Beam Radar Returns  
Fire Control Radar Systems  
Flight Deck Eye Protection  
Guide System Software Acquisition  
Host Pathogen Biocide Interactions  
Laboratory Animal Housing Modules  
Land Combat Weapons Effectiveness  
Laser Performance Decrement Studies  
Light Water Carbon Dioxide  
Novel Air Weapons Launching  
Plan Cut Foliage Preservation  
Radio Relay Retransmission Problems  
Range Speed Payload Potential  
Reentry Vehicle Vibration Predictions  
Room Temperature Copper Cavities  
Threat Level EMP Simulator  
Time Division Multiplex Equipment  
Traffic Ship Navigation Aids  
Transport Aircraft Crew Utilization  
Vapor Space Corrosion Inhibitors  
Vehicle Performance Terrain Relations  
Weapon Test Vulnerability Problem

# APPENDIX C

AAZ	1	forward deployed NATO	of forward deployed NATO general purpose forces with
AAZ	1	airborne moving target	to give <u>airborne moving target</u> indicating (MTI) radar systems for
AAZ	1	exact lower confidence	an exact lower confidence bound for the
AAZ	1	extremely low power	an <u>extremely low power</u> module IF that
AAZ	1	international ionized gas	at the ninth international ionized gas conference
AAZ	1	modular x-ray	tests of modular x-ray unit
AAZ	1	portable long base	semi-portable long base line interferometry with
AAZ	1	single integrated engineering	A <u>single integrated engineering</u> development effort will be
AAZ	1	x civil engineering	53x civil engineering services by contract:
AAZZ	1	coaxial dense plasma focus	A <u>coaxial dense plasma focus</u> device is being assembled
ANZ	3	consumable rockets launched	the application of <u>consumable rockets launched</u> from ocean bouys
ANZ	3	tropical oceans lead	studies over <u>tropical oceans</u> lead to the conclusion
AZZ	3	transonic speeds lead	airflow at <u>transonic speeds</u> lead to airfoil sertims
AZZZ	3	high speed vehicle flying	particles collected by <u>high speed vehicle flying</u> through rain
A+ZZ	3	filling gaps	will be updated by replacing new data for old and <u>filling gaps</u>
NAZ	3	monitor cardiovascular response	developed instrumentation to <u>monitor cardiovascular</u> response to various
NAZ	3	monitor environmental factors	<u>Monitor environmental factors</u> affecting acoustic transmission
NAZ	3	stress incapacitating agents	<u>Field warning system</u> which <u>stress incapacitating</u> agents and to
NAZ	3	stress inorganic materials	agents will <u>stress inorganic materials</u> for
NN	3	soldiers wounded	<u>the care of soldiers wounded on the battlefield</u>
AAZ	4	classical x-ray	by classical, x-ray and microprobe method of
AAZ	4	fast compact reliable	through <u>fast, compact, reliable</u> and flexible processors
AAZ	4	marine integrated fire	(3) <u>marine integrated fire</u> and support;

AAZ	4	marine integrated personnel	(4) marine integrated personnel and logistic;
AAZ	4	parallel extremely reliable	highly parallel, <u>extremely reliable</u> , and flexible processors
AAZ	4	utility heavy lift	configured for <u>utility</u> , <u>heavy lift</u> , and surveillance missions
AAZ	4	variable single seat	merged into <u>variable single seat</u> and multi-crew configurations as the
AAZ	4	amphibious overseas	support of <u>amphibious overseas</u> and remote area operations
AN	4	combined airblast	and the other with <u>combined airblast</u> and direct induced effects
AN	4	mixed zirconium	<u>Mixed zirconium</u> and whiskering graphite fibers to
AZAZ	5	electronic ports applied research	<u>electronic ports applied research</u> and engineering (Title)
AZZ	5	truck transmission matching	<u>effort on truck transmission matching</u> including automatic transmission
ZAN	5	event nuclear weapons	in the event <u>nuclear weapons</u> are used on
ZAZ	5	training technical domain	in the education and <u>training technical domain</u>
ZR	5	guide current	<u>maintain design guide current</u> as the state-of-the-art advance
ZZ	5	targets visible	that effective <u>engage targets visible</u> to the
ZZ	5	test command	a result of test operations at <u>test command DASA</u>
ZZZ	5	effects micro wave radiation	; <u>define effects micro wave radiation</u> on central nervous system,
ZZZ	5	problems problem areas	and will identify <u>problems problem areas</u> .
ZZZ	5	vehicle performance soil	<u>refine vehicle performance-soil</u> another vehicle performance-terrain relations
AAZ	6	the microbiological, nutritional, biochemical	the <u>microbiological, nutritional, biochemical</u> and chemical factors
ANZ	6	elastomeric sphere filled	and elastomeric sphere filled tire for increased
AZ	6	chemical biochemical	<u>chemical, biochemical, physical and microbiological</u> limitations

AZ	6	combined pitch	study of <u>combined pitch</u> and yaw oscillations
AZ	6	combined attitude	methods of <u>providing combined attitude</u> <u>sensing</u> and missile control
AZ	6	combined sound	the problem of <u>combined sound</u> , high temperature environment <u>simulation</u>
AZ	6	combined work	the combined work has led to a
AZ	6	empirically aid	to <u>empirically aid</u> in developing alternate ...
AZ	6	increasingly active	They will become increasingly active in the
AZ	6	physiological biochemical	through <u>physiological, biochemical</u> and chemical pathological investigations
AAZ	7	manual automatic control	; manual/automatic control application
AAZ	7	seismic mineral phase	mineral properties ( <u>seismic, mineral phase, electrical</u> ) at
AAZ	7	slender high velocity	of a <u>slender high velocity, oblique-angle, water-entry</u> will be
AA+ZZ	7	solid gas	, <u>solid/solid</u> and <u>solid/gas</u> equilibria
AAZZ	7	mid high intensity warfare	airmobility in <u>mid-high intensity warfare</u> in Europe
AZ	7	ceramic metal	and ceramic metal combinations
AZ	7	least operation	and not <u>least, operation</u> in adverse
AZ	7	lightweight reliable	prototypes of <u>lightweight, reliable, high performance</u> cryogenic coolers.
AZ	7	sensitive quantum	to evolve <u>sensitive quantum-electronic, parametation</u>
AZAZ	7	technical domain atmospheric	other <u>low-noise receivers</u> in the <u>technical domain-atmospheric environment</u>
AZ	8	national bureau	The <u>National Bureau of Standards</u>
ZPZZ	8	art surveys	<u>state-of-the-art surveys, designs data</u>
ZPNZ	8	Arizona contract	University of <u>Arizona contract F33615-70-C-1007</u> becomes
ZPNZ	8	Kentucky contract	The University of <u>Kentucky contract</u> will be considered for
ZPNZ	8	Korea army	by the Republic of <u>Korea army</u> .
ZPNZ	8	Tennessee space	at the University of <u>Tennessee space institute</u> ,
ZPNZ	8	Virginia contract	University of <u>Virginia contract F33615-69C-1048</u> becomes
ZPZZ	8	attack control	design of an <u>angle-of-attack control</u> for sounding rockets
ZPZZ	8	defense guidance	based on Department of <u>Defense guidance</u> concerning the
ZZ	8	error probable	, circle of <u>error probable</u>

NZN	9	demolition kit catering	of <u>demolition kit catering XM180 and</u>
NZN	9	detection techniques radar	<u>In the development of catering detection techniques</u> <u>radar and aircraft data</u>
NZZZ	9	terrain vehicle systems	<u>"Introduction of terrain-vehicle systems" University</u> <u>of Michigan press</u>
ZN	9	computers magnetohydrodynamics	<u>such as holography and computers magnetohydrodynamics</u> <u>and</u>
ZN	9	method graphite	<u>by this method graphite was converted to</u>
ZN	9	temperature humidity	<u>for measuring radiation, temperature humidity, density,</u> <u>composition</u>
ZZ	9	addition work	<u>In addition work will proceed on</u>
ZZ	9	molecular energy	<u>within the molecular energy can be redistributed</u>
ZZ	9	projects research	<u>under these sub-projects research will be</u>
ZZZ	9	studies documentation studies	<u>continue selected material handling studies documentation</u> <u>studies</u>
AAZ	10	destroying classified material	<u>methods of destroying classified material will</u>
AAZ	10	incapacitating Naval personnel	<u>present physiological hazards form incapacitating Naval</u> <u>personnel</u>
AAZ	10	manipulate factual data	<u>techniques to extract manipulate factual data from</u>
AAZ	10	propagating electromagnetic waves	<u>to study means of propagating electromagnetic waves</u> <u>through the</u>
AN	10	inhibit learning	<u>variables that facilitate or inhibit learning, to</u> <u>formulate</u>
AN	10	mixing helium	<u>one application of mixing helium and oxygen in</u>
ANN	10	mounting turbulence sensors	<u>techniques for mounting turbulence sensors on the</u>
AZ	10	absorbing heat	<u>this method of absorbing heat will be very effective</u>
AZ	10	classified standard	<u>that item by type classified standard A</u>
AZ	10	generating signals	<u>means of efficiently generating signals at micro wave,</u>

AAZ	11	electro optical ultraviolet	(e.g., electro optical, ultraviolet, etc.)
AAZ	11	extremely high radio	objects with <u>extremely high radio</u> , x-ray, ultraviolet, or infrared flux...
AAZ	11	light weight long life	improved efficiency, small size, <u>light weight long life</u> , greater reliability
AAZ	11	looking infrared display	a morning belt downward <u>looking infrared display</u> for
AAZ	11	optical reflection luminescent	sights include <u>optical reflection luminescent</u> , open and closed iron sights.
AN	11	quadripartite NATO	such international groups as <u>quadripartite</u> , NATO, SEATO, MWDA, etc.
AZ	11	alpha beta	a need to detect, in real time, <u>alpha beta</u> , gamma neutron and x-ray radiation
AZ	11	electron neutron	(3) <u>electron</u> , neutron, x-ray and molecular beam diffraction
AZ	11	mixing ignition	in <u>injection</u> , <u>mixing ignition</u> and combustion in
AZ	11	multiple phase	A <u>multiple phase</u> , 30 month, advanced development program is....
BN	12	new carborane	of <u>new carborane</u> compounds
ZZ	13	magnet off	the field of a magnet <u>off its axis</u> has been
ZZ	13	skid off	an uncontrolled <u>90 degree skid off the pavement</u>



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